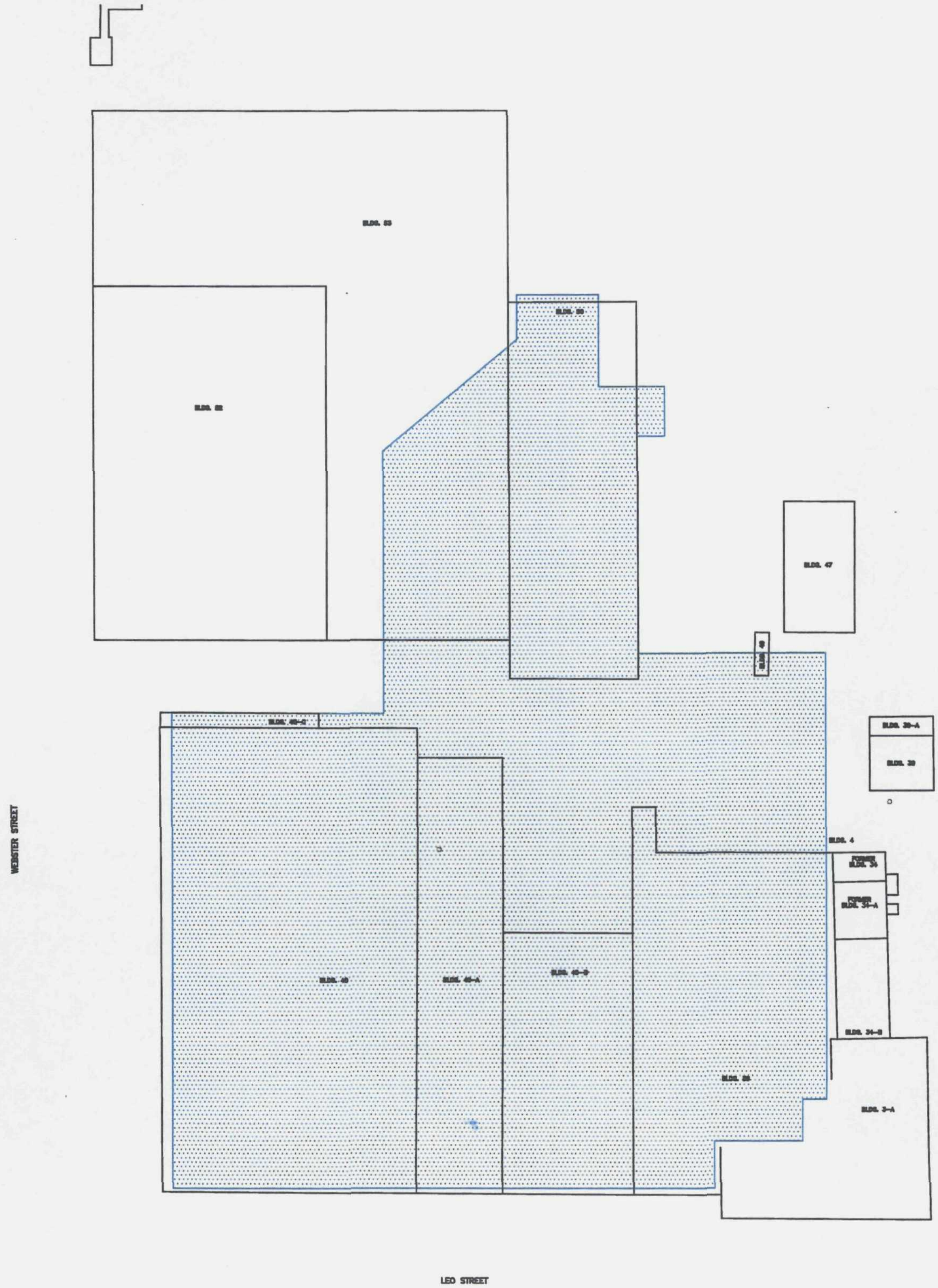
NORTH

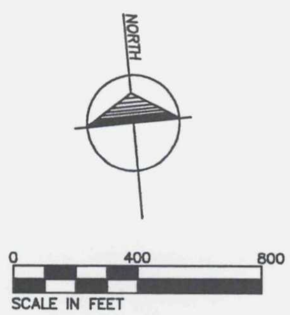
E A R T H T E C H

A tyco INTERNATIONAL LTD. COMPANY
4135 TECHNOLOGY PARKWAY, SHEBOYGAN, WISCONSIN 53083

FIGURE 1
VICINITY MAP
DAYTON THERMAL PRODUCTS SITE
DAYTON, OHIO

DRAWN BY: JRD	EDITED BY: JRD	PROJECT NUMBER: 55465	FILE NAME:
CHECKED BY: JE	DATE: DEC. 20, 2002	SCALE: -------	WELL PLACEMENT REV1





LEGEND

- PRIMARY SOIL CONTAMINANT SORCE AREA AND APPROXIMATE SVE SYSTEM COVERAGE

BASED ON DRAWING 3CHDA08K BY LBG.

SOURCE FOR BUILDING OUTLINE:
RALPH L. WOOLPERT CO.,
CONSULTING ENGINEERS,
DAYTON, OHIO DECEMBER 1967

SOURCE FOR HAZARDOUS WASTE STREAM & STORAGE TANK FACILITIES:
HUBBELL, ROTH & CLARK, INC.,
CONSULTING ENGINEERS,
BLOOMFIELD HILLS, MICHIGAN JUNE 1989

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
4135 Technology Parkway, Sheboygan, WI 53083 (920) 458-8711

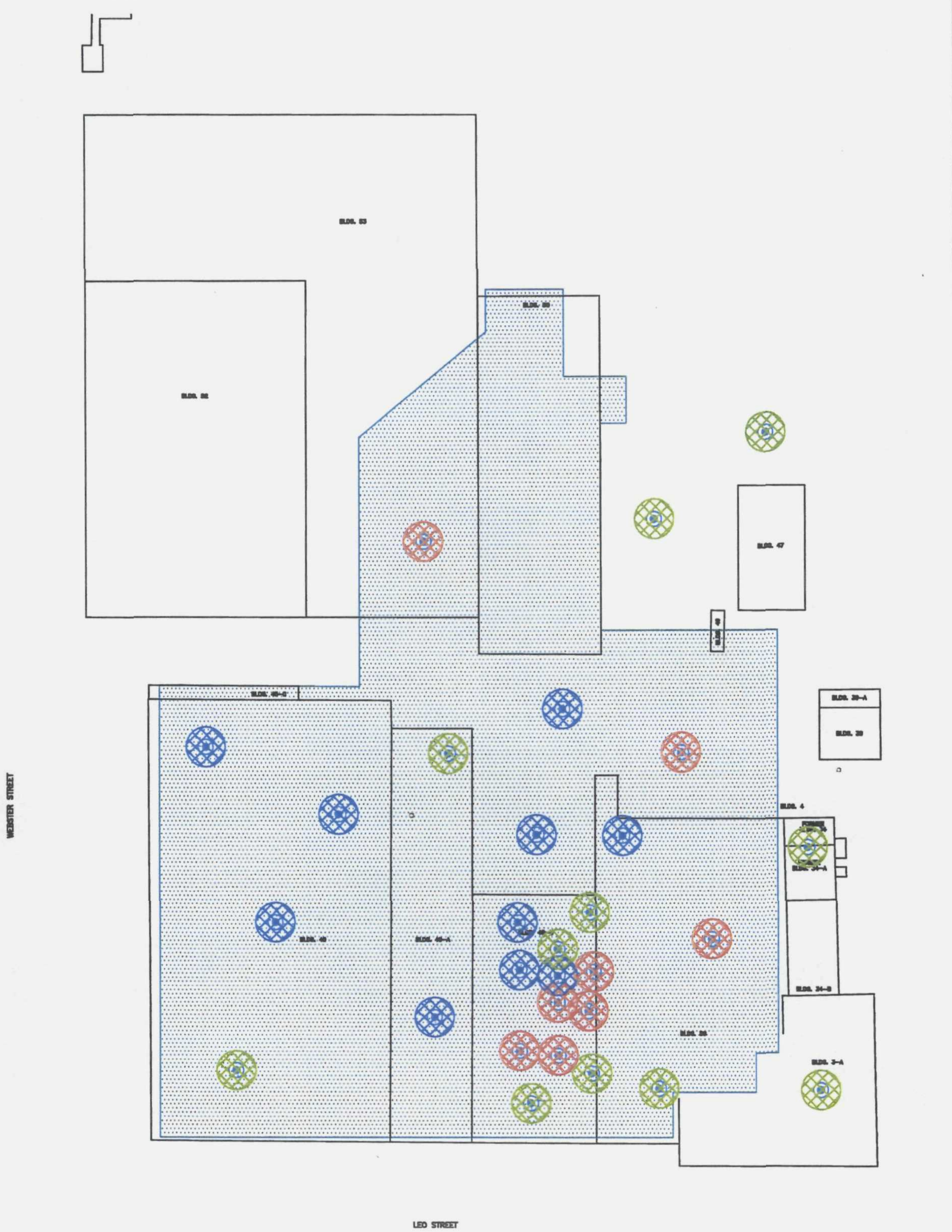
DRAWN BY: JRD	DATE: SEPT. 5, 2002
CHECKED BY: RS	EDITED BY: JRD090502
FILE NAME: SOURCE OVERLAY	

FIGURE 2

PRIMARY SOURCE AREA LOCATION MAP

DAYTON THERMAL PRODUCTS SITE
DAYTON, OHIO

PROJECT NUMBER 55465



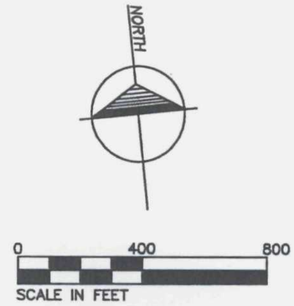
SVE POINT LEGEND

- > 15 LBS/MONTH VOC PRODUCTION @ 100 SCFM
- 5 – 15 LBS/MONTH VOC PRODUCTION @ 100 SCFM
- < 5 LBS/MONTH VOC PRODUCTION @ 100 SCFM
- PRIMARY SOIL CONTAMINANT SORCE AREA AND APPROXIMATE SVE SYSTEM COVERAGE

BASED ON DRAWING 3CHDAOSK BY LBG.

SOURCE FOR BUILDING OUTLINE:
RALPH L. WOOLPERT CO.,
CONSULTING ENGINEERS,
DAYTON, OHIO DECEMBER 1967

SOURCE FOR HAZARDOUS WASTE STREAM & STORAGE TANK FACILITIES:
HUBBELL, ROTH & CLARK, INC.,
CONSULTING ENGINEERS,
BLOOMFIELD HILLS, MICHIGAN JUNE 1989



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A tyco INTERNATIONAL LTD. COMPANY

DRAWN BY: JRD	DATE: SEPT. 5, 2002
CHECKED BY: RS	EDITED BY: JRD090502
FILE NAME: SOURCE OVERLAY	

FIGURE 3

SVE PILOT AND EXISTING WELL LOCATIONS

DAYTON THERMAL PRODUCTS SITE
DAYTON, OHIO

PROJECT NUMBER 55465

LEGEND

- EXISTING SVE WELL PAIR (SHALLOW AND DEEP)
- NEW WELLS (COLORS INDICATE BANKS)
- SVE PIPING
- SVE SYSTEM BUILDING

NORTH

0 250 500

SCALE IN FEET

E A R T H T E C H

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DRAWN BY: JRD	DATE: SEPT. 11, 2002
CHECKED BY: JE	EDITED BY: JRD091102

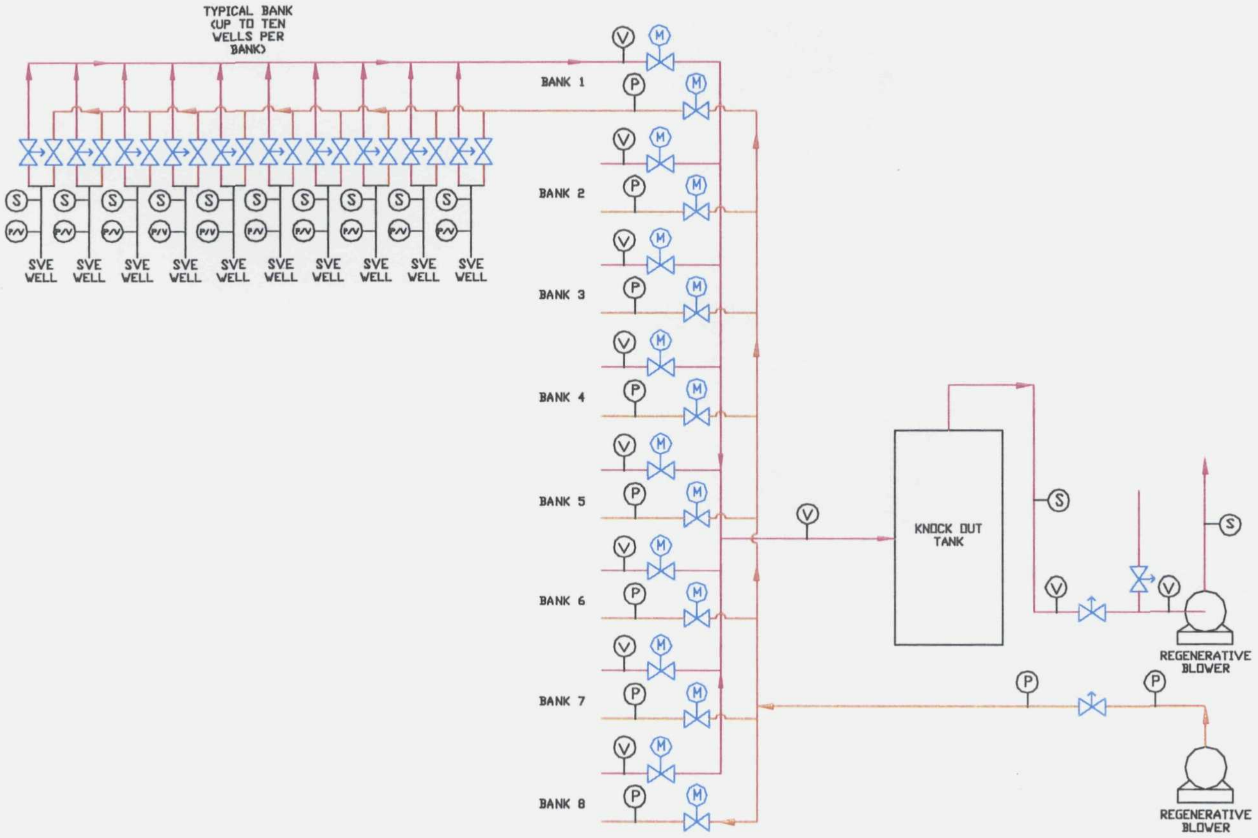
FILE NAME: BUILDING 40B SYSTEM

FIGURE 4

SVE SYSTEM LAYOUT
WELL AND PIPING LOCATION

DAYTON THERMAL PRODUCTS SITE
DAYTON, OHIO

PROJECT NUMBER 55465



LEGEND

- COMBINED PRESSURE VACUUM GUAGE/SENSOR
- PRESSURE GUAGE/SENSOR
- VACUUM GUAGE/SENSOR
- SAMPLE PORT/PARAMETER SENSOR
- THROTTLE VALVE
- ISOLATION VALVE
- MOTORIZED BUTTERFLY VALVE
- EXTRACTION PIPING
- INJECTION PIPING

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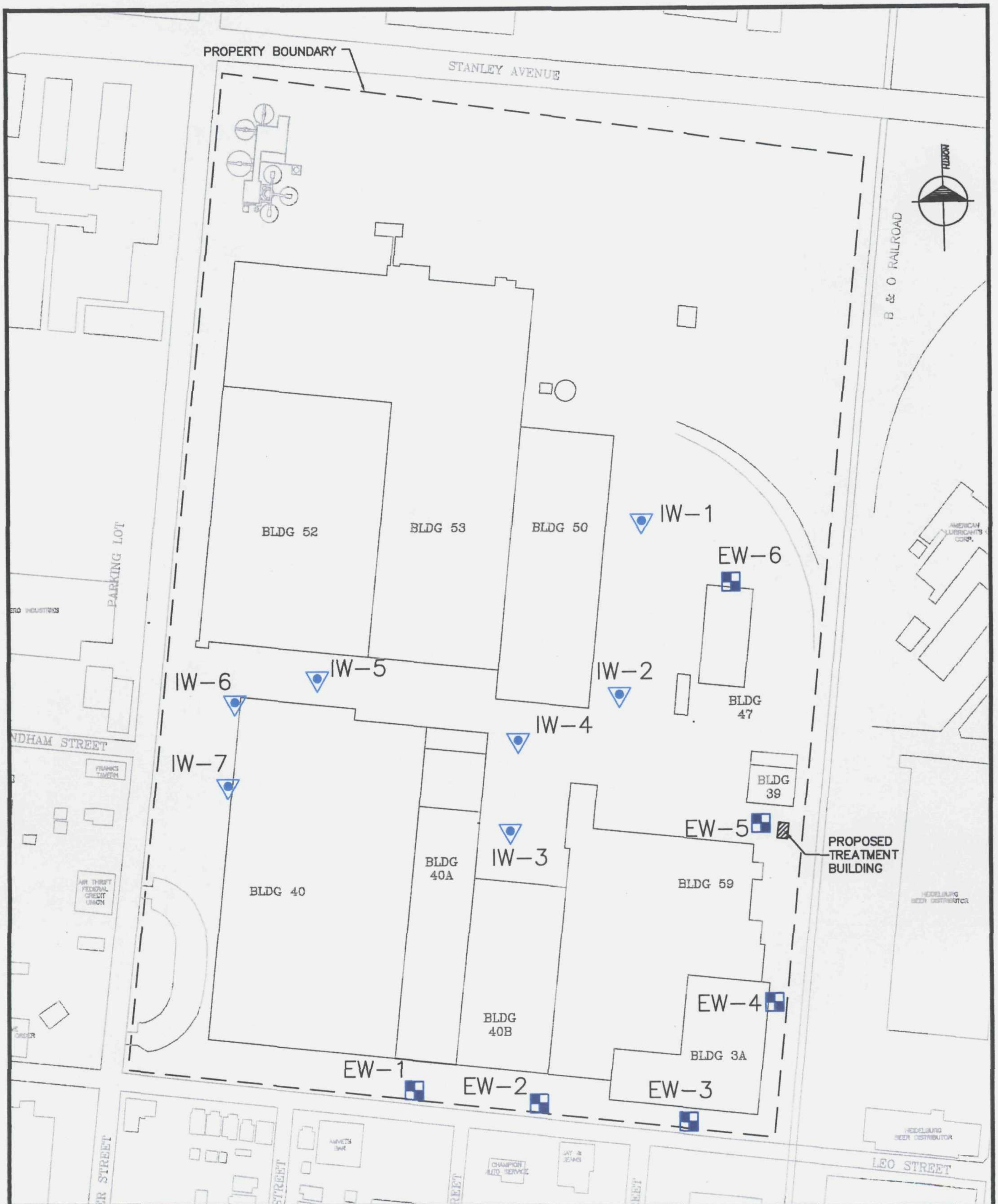
DRAWN BY: JRD	DATE: JULY 8, 2002
CHECKED BY: JE	EDITED BY: JRD070802
FILE NAME: GW PIDs	

FIGURE 5

SOIL VAPOR EXTRACTION
PROCESS FLOW AND INSTRUMENTATION DIAGRAM

DAYTON THERMAL PRODUCTS SITE
DAYTON, OHIO

PROJECT NUMBER 55465



LEGEND

- PROPOSED INJECTION WELLS
- PROPOSED EXTRACTION WELLS

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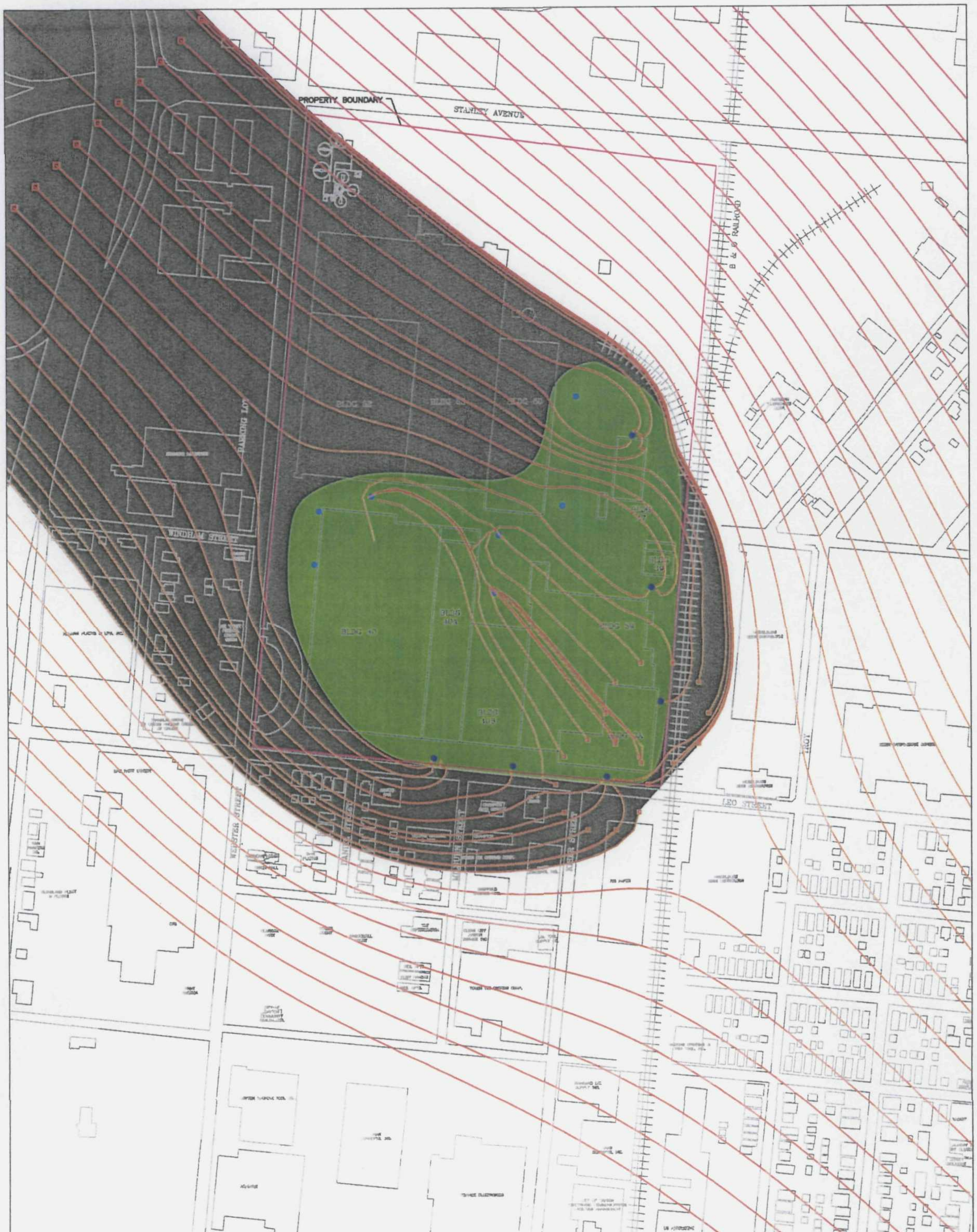
4135 TECHNOLOGY PARKWAY, SHEBOYGAN, WISCONSIN 53083

FIGURE 6
WELL LOCATIONS
DAYTON THERMAL PRODUCTS SITE
DAYTON, OHIO

DRAWN BY: JRD	EDITED BY: JRD	PROJECT NUMBER: 55465	FILE NAME:
CHECKED BY: JE	DATE: MARCH 4, 2003	SCALE: 1:250	WELLS.DWG



LEGEND

- PROPOSED EXTRACTION WELL LOCATION
- PROPOSED INJECTION WELL LOCATION
- PARTICLE TRACE
- PROPERTY BOUNDARY
- SODIUM LACTATE TREATMENT ZONE
- APPROXIMATE CAPTURE ZONE

N

0' 150' 300' 600'

SCALE

E A R T H T E C H

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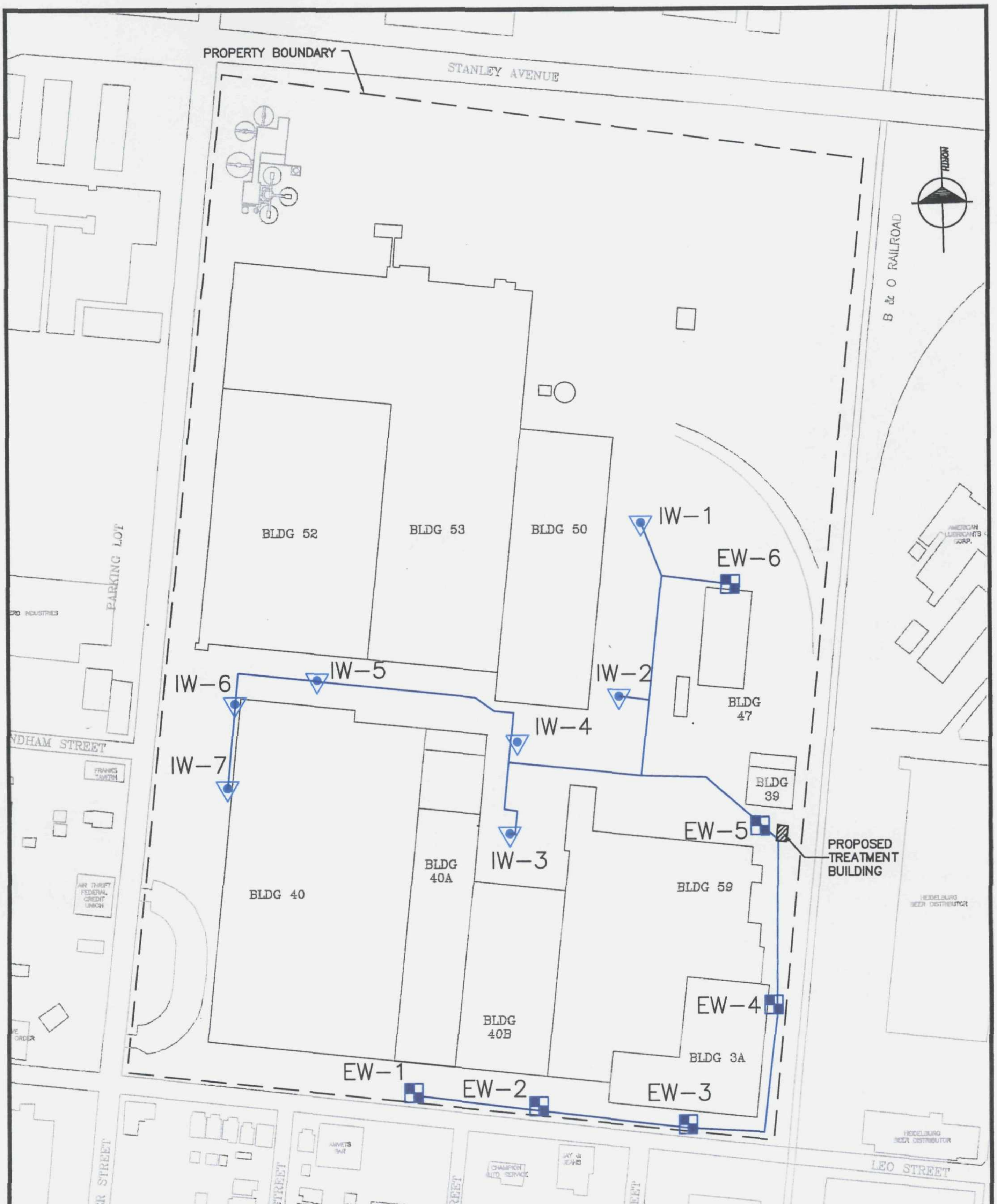
DRAWN BY: JRD	DATE: MARCH 4, 2003
CHECKED BY: JE	EDITED BY: JRD
FILE NAME: FLOW MODEL NORMAL	

FIGURE 7

CAPTURE ZONE AND
STREAMLINES FOR GROUNDWATER
REMEDY UNDER NORMAL FLOW DIRECTION

DAYTON THERMAL PRODUCTS SITE
DAYTON, OHIO

PROJECT NUMBER 55465



LEGEND

- PROPOSED INJECTION WELLS
- PROPOSED EXTRACTION WELLS
- TRENCH AND PIPE

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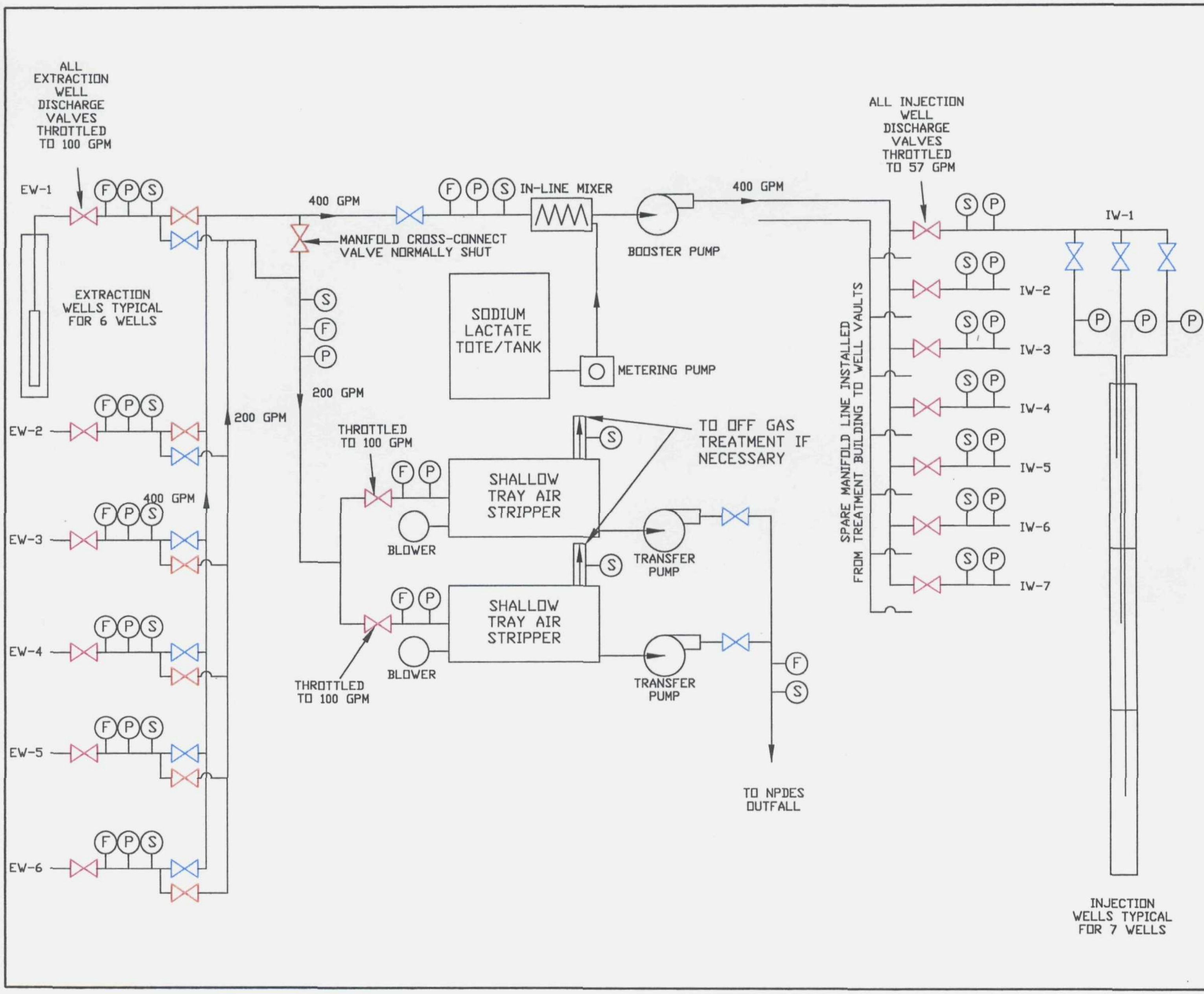
4135 TECHNOLOGY PARKWAY, SHEBOYGAN, WISCONSIN 53083

FIGURE 8
WELL LOCATIONS
DAYTON THERMAL PRODUCTS SITE
DAYTON, OHIO

DRAWN BY: JRD	EDITED BY: JRD	PROJECT NUMBER: 55465	FILE NAME:
CHECKED BY: JE	DATE: MARCH 4, 2003	SCALE: 1:250	WELLS.DWG



LEGEND

- F - FLOWMETER/SENSOR
- P - PRESSURE DETECTOR/SENSOR
- S - SAMPLE PORT/PARAMETER SENSOR
- VALVE NORMALLY OPEN
- VALVE NORMALLY THROTTLED
- VALVE NORMALLY SHUT

EARTH TECH

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DRAWN BY: JRD	DATE: JULY 8, 2002
CHECKED BY: JE	EDITED BY: JRD070802
FILE NAME: GW PIDs	

FIGURE 9

PROCESS FLOW AND INSTRUMENTATION DIAGRAM

DAYTON THERMAL PRODUCTS SITE
DAYTON, OHIO

PROJECT NUMBER 55465

LEGEND

- PROPOSED MP LOCATION

- PROPOSED MP/WATER TABLE WELL LOCATION

SCALE 0' 500' 1000' 2000'

EARTH TECH

A tyco INTERNATIONAL LTD. COMPANY

DRAWN BY: JRD	DATE: MARCH 4, 2003
CHECKED BY: RS	EDITED BY: JRD
FILE NAME: PROPOSED MONITORING POINTS	

FIGURE 10

OFF-SITE PLUME INVESTIGATION AREA

Appendix A - Hydraulic Conductivity Technical Memorandum

MEMO

Date: June 26, 2002

To: Joan Underwood **cc:** Rob Stenson, Drew Lonergan

From: Mike Wolf/Tom Sampson

Subject: DC DAYTON AQUIFER TESTING

Aquifer hydraulic conductivity was determined by conducting slug tests at selected monitoring wells (MWB1, MWC1, PZ7I, MWB5, PZ8I, PZ8D, MWB3, PZ-16D, MWA2, MWB2, MWC2). Slug test equipment included a Hermit SE1000 data logger, 20 psi transducer, electronic water level indicator, K-packer assembly and a vacuum pump. A water level meter was used to measure the depth to water. The transducer was placed in the well approximately 15 to 20 feet below the water table and connected to the data logger through the K-packer assembly. The K-packer assembly was used to seal off the well from atmospheric pressure. The data logger records the change in groundwater level in the well as measured by the transducer.

The K-packer assemblage allows a vacuum to be created in the well casing utilizing the vacuum pump. The vacuum is applied to the well casing through tubing connected to an air port linked to the inside of the K-packer. The vacuum lifts a column of water in the well casing. When water appears in the vacuum tubing at the surface, a large diameter ball valve (2-inch) is opened which releases the vacuum and causes the column of water to flow back into the formation. This is correlative to dropping a PVC slug into the well and conducting a falling head test. Conversely, the well casing can be pressurized by connecting the tubing to the air outlet side of the vacuum pump, allowing for the depression of the water table. Releasing the air pressure allows the aquifer water to reenter the well casing and stabilize. This is correlative to removing a PVC slug from the well casing and conducting a rising head test.

Groundwater displacement (feet) and time (minutes) data were recorded during the rising head and falling head slug tests.

Data collected from several of the wells showed an oscillation of the water level after the slug of water was released. These data were processed using a different method than the "normal" slug test data.

Well and Aquifer Parameters

The data were analyzed following the Bouwer and Rice (1976) method for unconfined aquifers; however, the oscillating data sets were evaluated using a spreadsheet developed by the Kansas Geological Survey that is an extension of the Bouwer and Rice (1976) method. Based on the oscillating data set, a type curve is developed and matched to the oscillating data. The Bouwer and Rice equation is then corrected by parameters used in matching the type curve to the data.

The non-oscillating data were evaluated with the Bouwer and Rice method using AQTESOLV computer software (HYDROSOLVE, Inc., 1996). The following well and aquifer parameters were obtained from well logs to assist in the curve matching: radius of borehole (r_w), radius of well casing (r_c), aquifer saturated thickness (b), effective well screen length (L), static height of water in the well (D), and filter pack porosity. The parameters vary based on the hydrogeologic conditions in the vicinity of the well.

The radius of well casing (r_c) is the radius of the well screen and well riser pipe. All of the well casings tested were two inches in diameter (r_c = 0.083 feet). The borehole radius (r_w) varies depending on the drilling method used and on the hydraulic contrast between the well filter pack and the formation. If the filter pack and the screened formation are hydraulically similar, then r_w is equal to the radius of the well casing (HYDROSOLVE, 1996). If the filter pack and the screened formation are hydraulically dissimilar, then r_w is equal to the radius of the borehole. All wells tested during this project assumed the filter pack to be hydraulically dissimilar to the formation being screened, therefore, r_w is assumed equal to the radius of the borehole. An assumption of an 8-inch borehole was used (r_w = 0.33 feet).

Aquifer saturated thickness (b) is the estimated saturated thickness of the aquifer being tested, within the effective well screen length of the well. Effective well screen length (L) varies depending on the hydraulic contrast between the well filter pack and the formation. If the filter pack and the screened formation are hydraulically similar, then L is equal to the length of the well screen (Bouwer and Rice, 1976, Bouwer, 1989). If the filter pack and the screened formation are hydraulically dissimilar, then L is equal to the length of the filter pack interval. However, if the water level intersects the well screen at the time of field testing, L equals the length from the bottom of the well to the water level.

All wells assumed the filter pack to be hydraulically similar to the formation being screened. Therefore, the effective screen length (L) was the length of the well screen.

The static height of water in the well (D) is the length from the bottom of the well to the water level. Filter pack porosity was estimated at 30 percent, which is within the porosity range for sand cited in standard literature (Freeze and Cherry, 1979; Domenico and Schwartz, 1990).

Curve matching assumptions

The underlying assumptions involved with the Bouwer and Rice method include: 1) Drawdown of the water table around the well is negligible; 2) Flow above the water table (capillary fringe) can be ignored; 3) Well losses are negligible; 4) The aquifer is homogeneous and isotropic; 5) The aquifer has infinite areal extent; 6) Aquifer is confined or unconfined; 7) Flow is steady; 8) A volume of water, V, is injected into or discharged from the well instantaneously; 9) Aquifer potentiometric surface is initially horizontal. Of these assumptions, Nos. 2 and 3 are typically met in field conditions. Assumptions No. 1 and No. 9 are met if the amount of initial drawdown is small. Assumption No. 4 is more difficult to meet since a geologic formation is rarely homogeneous and isotropic. For most practical purposes, assumption No. 5 is valid for slug testing. Freeze and Cherry (1979) note that geologic formations are usually heterogeneous and anisotropic, and consequently that the hydraulic conductivity values should be viewed as "best estimates".

Selection of the segment of the data plot of the natural logarithm of displacement/drawdown versus time to be used for the calculation of hydraulic conductivity is based on the fit of a straight line to the data (Bouwer and Rice, 1976). The straight-line portion of a plot of recovery versus time is the valid data to be used in the analysis. The non-oscillating drawdown data were evaluated using AQTESOLV.

The hydraulic conductivities calculated from the aquifer testing are summarized in Table 1. The spreadsheets and type curve-matching plots for the oscillating data are presented in Attachment A. The AQTESOLV curve-matching plots of the data are provided in Attachment B.

The hydraulic conductivities calculated using the spreadsheet for the oscillating data ranged from 72 to 172 feet/day ($2x10^{-2}$ to $6x10^{-2}$ cm/sec). The hydraulic conductivities calculated using the AQTESOLV program ranged from 112 to 1636 ft/day ($3.9x10^{-2}$ to $5.8x10^{-1}$ cm/sec). The hydraulic conductivity based on the GEM pump test data is approximately 750 ft/day ($2.6x10^{-1}$ cm/sec), which is similar to the values calculated using the non-oscillating slug test data. Soil boring logs for the wells generally indicate sand and gravel across the screened intervals that correspond to the high hydraulic conductivities observed.

Table 1
Hydraulic Conductivities

Well ID	Type	Evaluation Bower-Rice Only /Oscillation	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (ft/day)
MW-A2	Falling	OSC	0.06	171
MW-B1	Rising	OSC	0.03	80
MW-B1	Rising	OSC	0.05	72
MW-B1	Falling	OSC	0.06	154
MW-B2	Rising	BR	0.06	182
MW-B2	Falling	BR	0.006	17
MW-B3	Rising	BR/OSC	0.32/0.02	908/63
MW-B3	Falling	BR	0.4	1136
MW-B5	Rising	OSC	0.03	76
MW-B5	Falling	OSC	0.04	118
MW-C1	Rising	BR	0.02	569
MW-C2	Rising	BR	0.04	114
MW-C2	Falling	BR	0.04	112
PZ-7I	Rising	BR	0.45	1267
PZ-7I	Falling	BR	0.45	1255
PZ-8I	Rising	BR	0.56	1602
PZ-8I	Falling	BR	0.58	1636
PZ-8D	Rising	BR	0.48	1354
PZ-8D	Falling	BR	0.45	1273
PZ-16D	Rising	BR	0.30	844
PZ-16D	Falling	BR	0.36	1031

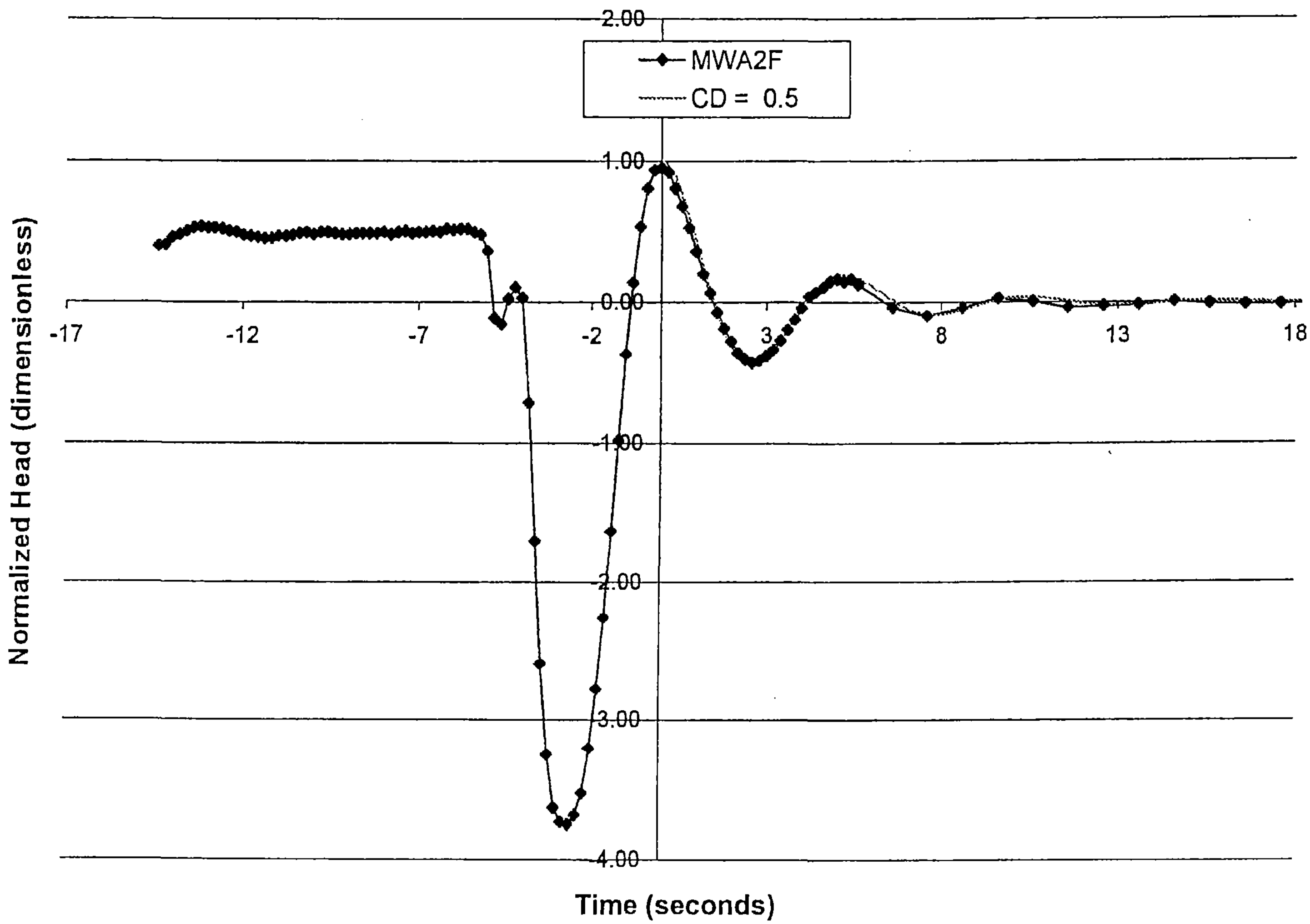
ATTACHMENT A

Oscillating Data Plots and Spreadsheets

MW-A2
Falling Head

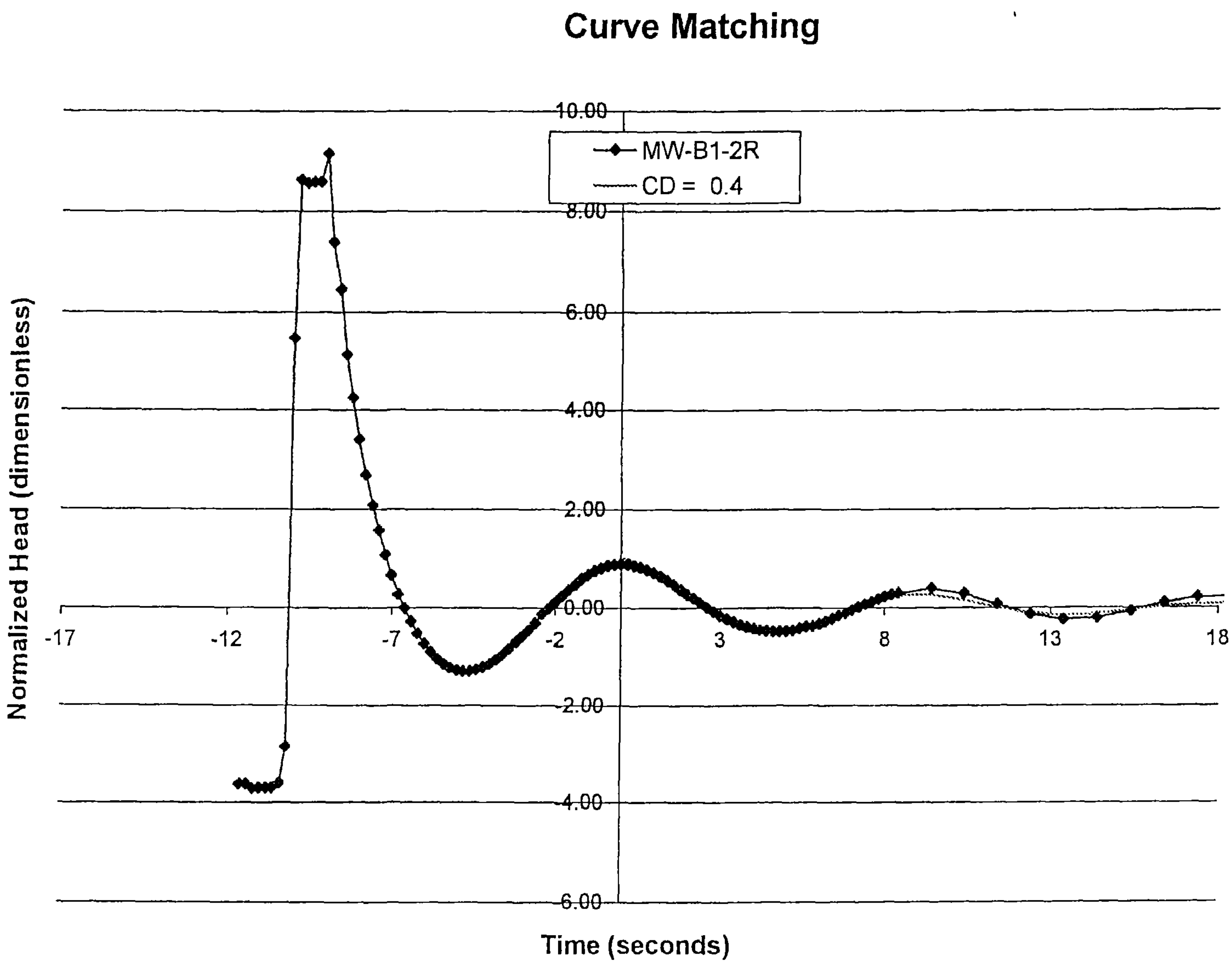
	L	M	N	O	P	Q	R	S	T	U	V	W
1												
2			**Best Fit**				**Confined - High-K Hvorslev Model**					
3	**Time**		**Type Curve**									
4	**Correlation Ratio**		**C_D**				K_r =	t_d* r_c^2 ln[b/(2r_w*)+(1+(b/(2r_w*))^2)^0.5]				
5	**t_d*/t***		0.5					t*	2bC_D			
6	1.250											
7							Bracketted quantity				26.704	
8	computed from ratio	Le =	20.61	ft								
9	nominal	Le =	11.77	ft			**K_r =**	**2.79E-03 ft/sec**				
10	% difference		75%					**2.41E+02 ft/day**		**7.35E+01 m/day**		
11								**8.51E-02 cm/sec**				
12												
13	**Modulation Factor =**		0.800				**Unconfined - High-K Bouwer and Rice Model**					
14												
15							K_r =	t_d* r_c^2 ln[R_e/r_w*]				
16	**Dimensionless**	**C_D =**		**Adjusted**				t* 2bC_D				
17	**Time**	**0.5**		**Time**								
18	0	1		0			ln(R_e/r_w*)=	2.322		*A* =	2.359	
19	0.1	0.995086		0.0800						*B* =	0.373	
20	0.2	0.980714		0.1600				first term	1.1/(ln((d+b)/r_w*)			
21	0.3	0.957485		0.2400					0.272			
22	0.4	0.926057		0.3200				second term		(*A*+*B**(ln[(B-(d+b))/r_w*]))/(b/r_w*)		
23	0.5	0.887137		0.4000						0.159		
24	0.6	0.841468		0.4800				ln[(B-(d+b))/r_w*]		5.049		
25	0.7	0.789826		0.5600						Cannot exceed 6.		
26	0.8	0.733005		0.6400						See Butler (1997) - p.108.		
27	0.9	0.671812		0.7200								
28	1	0.607055		0.8000			**K_r =**	**1.97E-03 ft/sec**				
29	1.1	0.53954		0.8800				**1.71E+02 ft/day**		**5.20E+01 m/day**		
30	1.2	0.47006		0.9600				**6.03E-02 cm/sec**				

Curve Matching



MW-B1
Rising Head

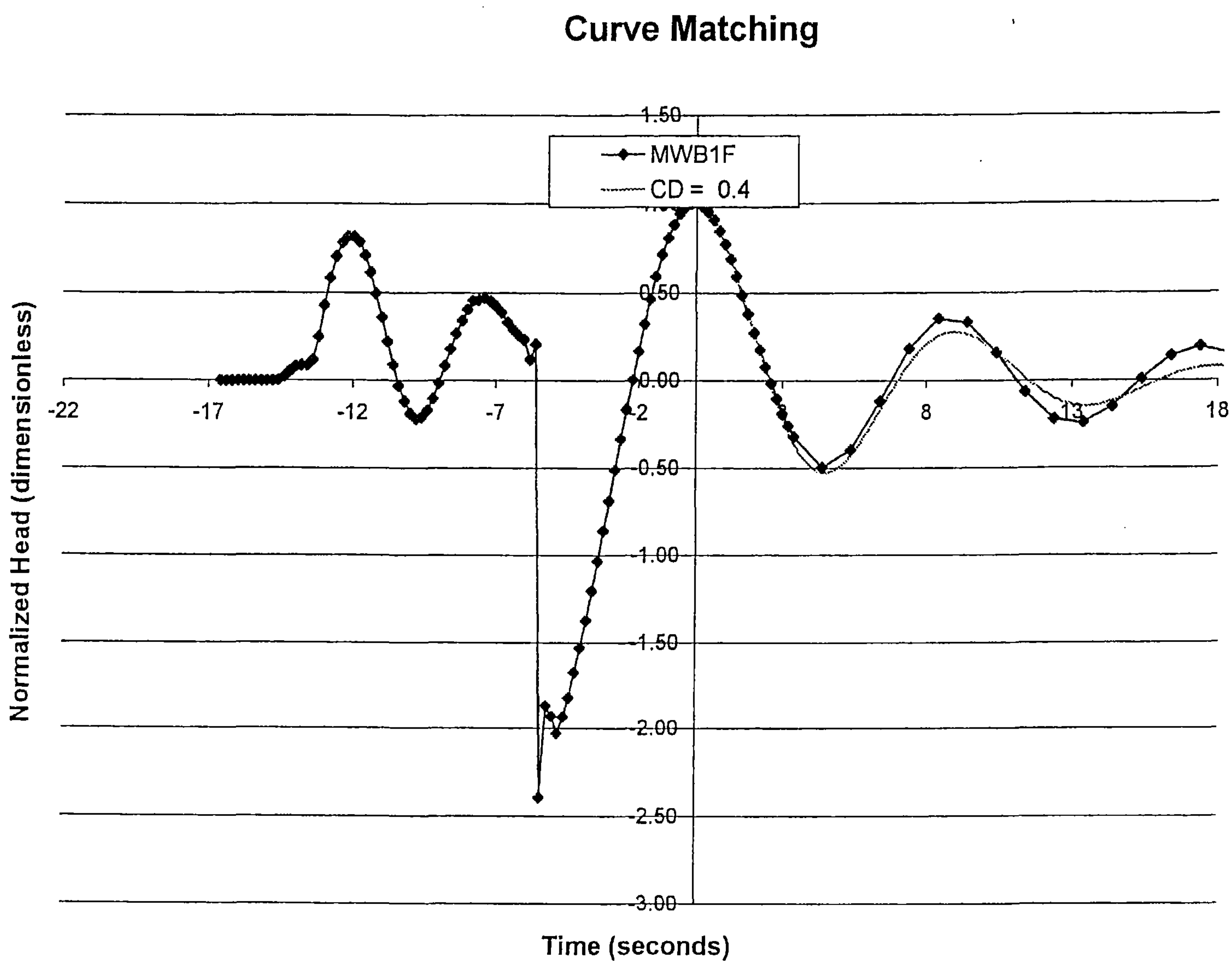
	L	M	N	O	P	Q	R	S	T	U	V	W
1												
2			**Best Fit**				**Confined - High-K Hvorslev Model**					
3	**Time**		**Type Curve**									
4	**Correlation Ratio**		C_D				K_r =	t_d* r_c^2 ln[b/(2r_w*)+(1+(b/(2r_w*))^2)^0.5]				
5	**t_d*/t***		0.4					t*	$2bC_D$			
6	0.714											
7							Bracketted quantity				26.704	
8	computed from ratio	Le =	63.11	ft								
9	nominal	Le =	51.31	ft			**K_r =**	**1.99E-03 ft/sec**				
10	% difference		23%					**1.72E+02 ft/day**		**5.25E+01 m/day**		
11								**6.08E-02 cm/sec**				
12												
13	**Modulation Factor =**		1.400				**Unconfined - High-K Bouwer and Rice Model**					
14												
15							K_r =	t_d* r_c^2 ln[R_e/r_w*]				
16	**Dimensionless**	**C_D =**		**Adjusted**				t* $2bC_D$				
17	**Time**	**0.4**		**Time**								
18	0	1		0			ln(R_e/r_w*)=	2.939		***A*** =	2.359	
19	0.1	0.99507		0.1400						***B*** =	0.373	
20	0.2	0.980587		0.2800				first term	1.1/(ln((d+b)/r_w*)			
21	0.3	0.957068		0.4200					0.209			
22	0.4	0.925097		0.5600				second term		(***A*** +***B*** *(ln[(B-(d+b))/r_w*]))/(b/r_w*)		
23	0.5	0.885319		0.7000						0.131		
24	0.6	0.838429		0.8400				ln[(B-(d+b))/r_w*]		3.051		
25	0.7	0.785166		0.9800						Cannot exceed 6.		
26	0.8	0.726301		1.1200						See Butler (1997) - p.108.		
27	0.9	0.66263		1.2600								
28	1	0.594966		1.4000			**K_r =**	**1.78E-03 ft/sec**				
29	1.1	0.524128		1.5400				**1.54E+02 ft/day**		**4.70E+01 m/day**		
30	1.2	0.450934		1.6800				**5.45E-02 cm/sec**				


Curve Matching
MW-B1-2R
CD = 0.4
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
-6.00
-17
-12
-7
-2
3
8
13
18
Normalized Head (dimensionless)
Time (seconds)

MW-B1
Falling Head

	L	M	N	O	P	Q	R	S	T	U	V	W
1												
2			**Best Fit**				**Confined - High-K Hvorslev Model**					
3	**Time**		**Type Curve**									
4	**Correlation Ratio**		**C_D**				K_r =	$t_d^* r_c$^2 ln[b/(2r_w^*)+(1+(b/(2r_w^*))^2)^0.5]				
5	**t_d*/t***		0.4					t*	2bC_D			
6	0.714											
7							Bracketted quantity				26.704	
8	computed from ratio	Le =	63.11	ft								
9	nominal	Le =	51.31	ft			**K_r =**	**1.99E-03 ft/sec**				
10	% difference		23%					**1.72E+02 ft/day**		**5.25E+01 m/day**		
11								**6.08E-02 cm/sec**				
12												
13	**Modulation Factor =**		1.400				**Unconfined - High-K Bouwer and Rice Model**					
14												
15							K_r =	$t_d^* r_c$^2 ln[R_e/r_w^*]				
16	**Dimensionless**	**C_D =**		**Adjusted**				t* 2bC_D				
17	**Time**	**0.4**		**Time**								
18	0	1		0			ln(R_e/r_w^*)=	2.939		*A* =	2.359	
19	0.1	0.99507		0.1400						*B* =	0.373	
20	0.2	0.980587		0.2800				first term	1.1/(ln((d+b)/r_w^*)			
21	0.3	0.957068		0.4200					0.209			
22	0.4	0.925097		0.5600				second term		(*A* +*B* *(ln[(B-(d+b))/r_w^*]))/(b/r_w^*)		
23	0.5	0.885319		0.7000						0.131		
24	0.6	0.838429		0.8400				ln[(B-(d+b))/r_w^*]		3.051		
25	0.7	0.785166		0.9800						Cannot exceed 6.		
26	0.8	0.726301		1.1200						See Butler (1997) - p.108.		
27	0.9	0.66263		1.2600								
28	1	0.594966		1.4000			**K_r =**	**1.78E-03 ft/sec**				
29	1.1	0.524128		1.5400				**1.54E+02 ft/day**		**4.70E+01 m/day**		
30	1.2	0.450934		1.6800				**5.45E-02 cm/sec**				

L:/55465/projadmin/slug tests/MWB1F High K.xls

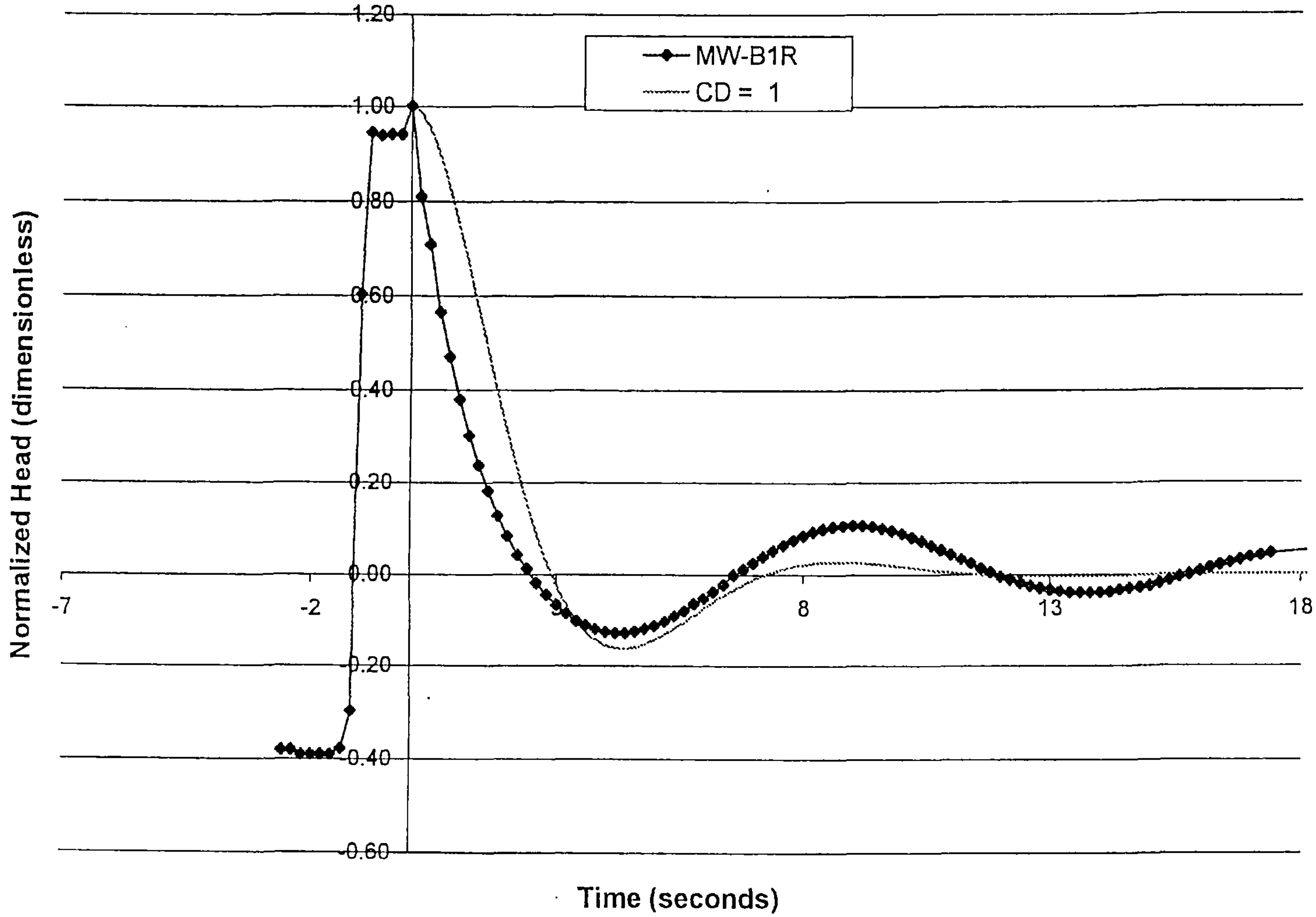


Curve Matching
1.50
0.50
0.00
-0.50
-1.00
-1.50
-2.00
-2.50
-3.00
-22
-17
-12
-7
-2
8
13
18
MWB1F
CD = 0.4
Normalized Head (dimensionless)
Time (seconds)

MW-B1
Rising Head

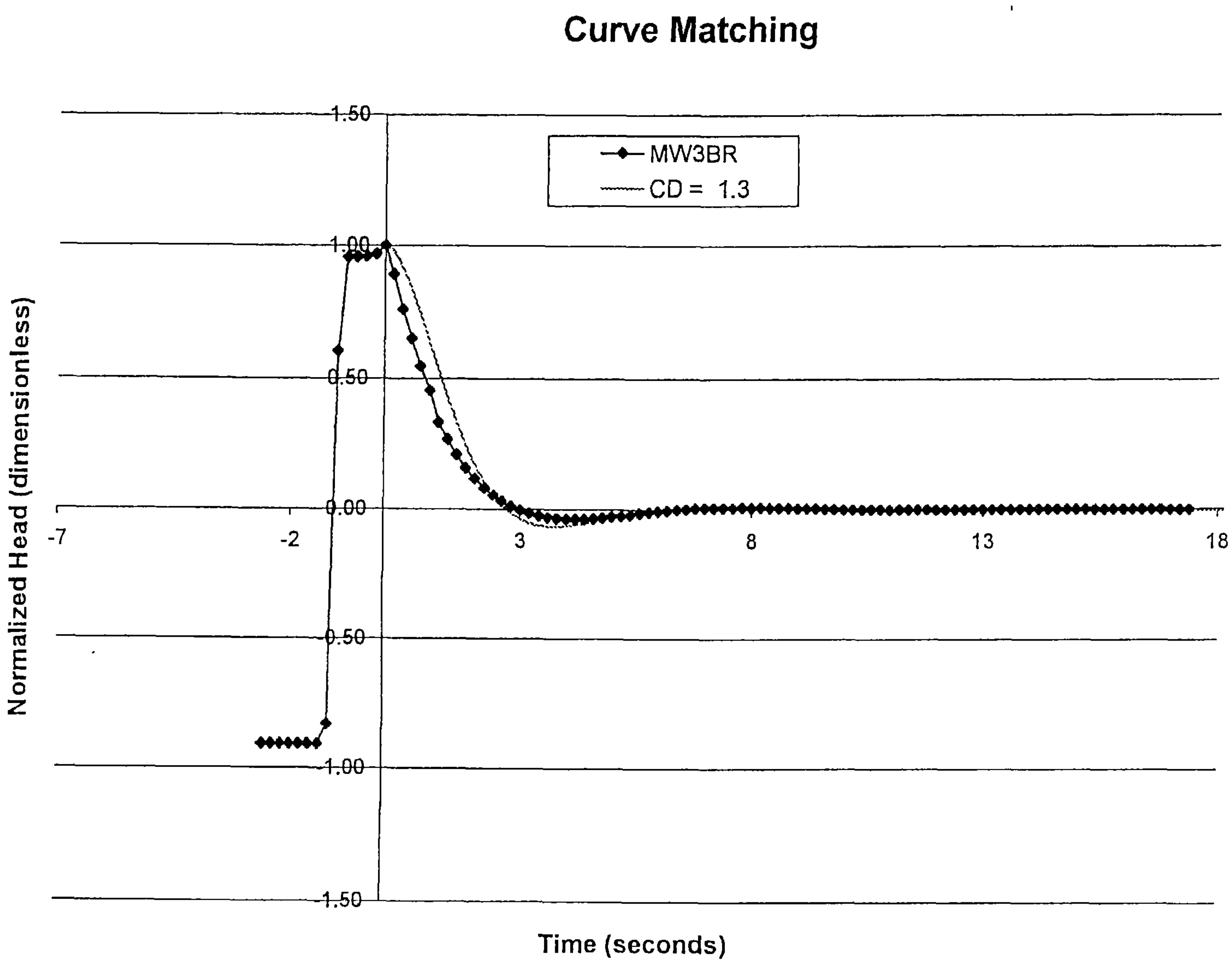
	L	M	N	O	P	Q	R	S	T	U	V	W
1												
2			**Best Fit**				**Confined - High-K Hvorslev Model**					
3	**Time**		**Type Curve**									
4	**Correlation Ratio**		**C_D**				K_r =	t_d* r_c^2 ln[b/(2r_w*)+(1+(b/(2r_w*))^2)^0.5]				
5	**t_d*/t***		1					t*	$2bC_D$			
6	0.833											
7							Bracketted quantity				26.704	
8	computed from ratio	Le =	46.37	ft								
9	nominal	Le =	51.31	ft			**K_r =**	**9.31E-04 ft/sec**				
10	% difference		10%					**8.04E+01 ft/day**		**2.45E+01 m/day**		
11								**2.84E-02 cm/sec**				
12												
13	**Modulation Factor =**		1.200				**Unconfined - High-K Bouwer and Rice Model**					
14												
15							K_r =	t_d* r_c^2 ln[R_e/r_w*]				
16	**Dimensionless**	**C_D =**		**Adjusted**				t* $2bC_D$				
17	**Time**	**1**		**Time**								
18	0	1		0			ln(R_e/r_w*)=	2.939		*A* =	2.359	
19	0.1	0.995167		0.1200						*B* =	0.373	
20	0.2	0.981331		0.2400				first term	1.1/(ln((d+b)/r_w*))			
21	0.3	0.959481		0.3600					0.209			
22	0.4	0.930587		0.4800				second term		(*A*+*B**(ln[(B-(d+b))/r_w*]))/(b/r_w*)		
23	0.5	0.895595		0.6000						0.131		
24	0.6	0.855416		0.7200				ln[(B-(d+b))/r_w*]		3.051		
25	0.7	0.810928		0.8400						Cannot exceed 6.		
26	0.8	0.762963		0.9600						See Butler (1997) - p.108.		
27	0.9	0.712308		1.0800								
28	1	0.6597		1.2000			**K_r =**	**8.33E-04 ft/sec**				
29	1.1	0.605826		1.3200				**7.19E+01 ft/day**		**2.19E+01 m/day**		
30	1.2	0.551319		1.4400				**2.54E-02 cm/sec**				

Curve Matching



MW-B3
Rising Head

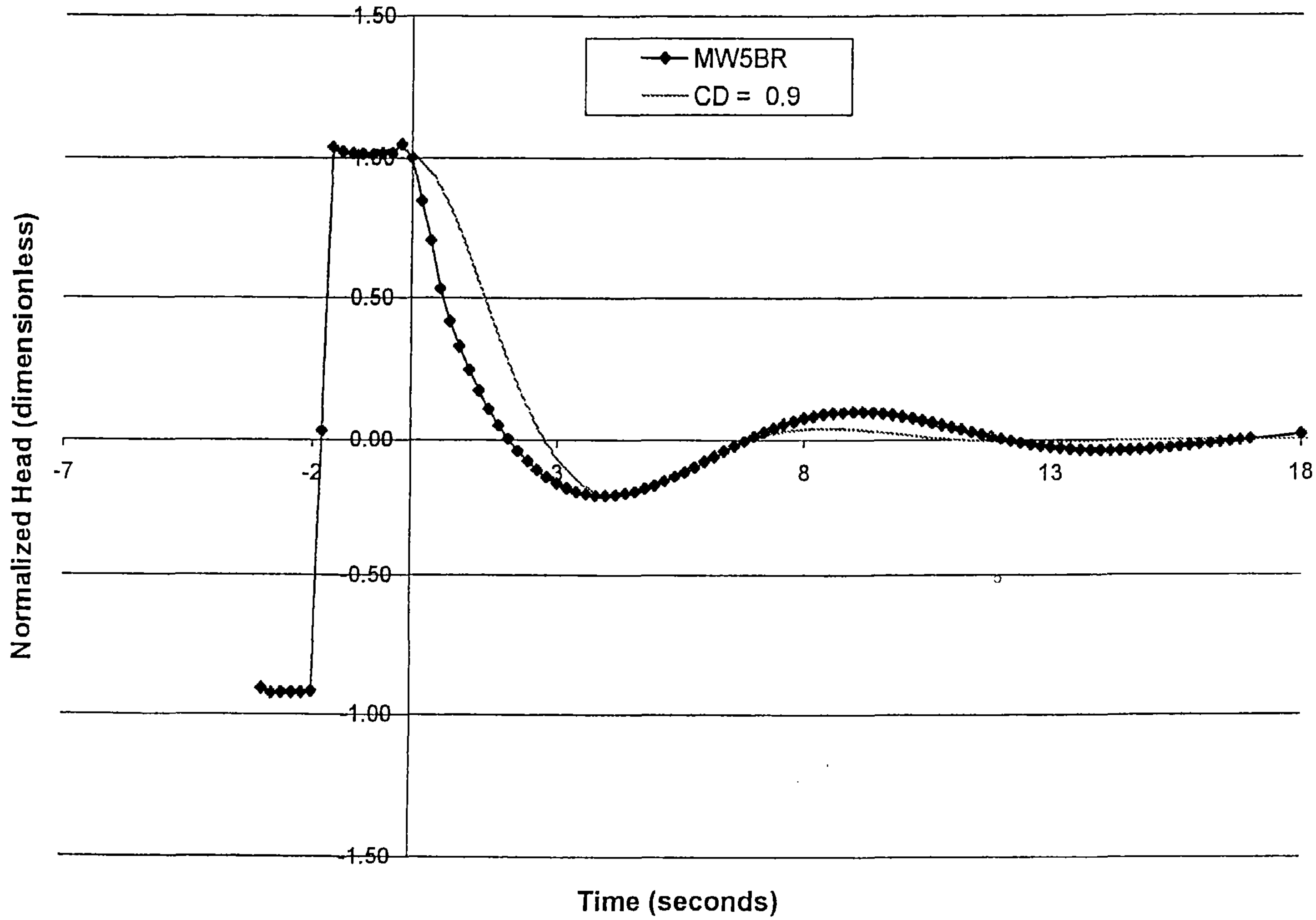
	L	M	N	O	P	Q	R	S	T	U	V	W
1												
2			**Best Fit**				**Confined - High-K Hvorslev Model**					
3	**Time**		**Type Curve**									
4	**Correlation Ratio**		**C_D**				K_r =	t_d* r_c^2 ln[b/(2r_w*)+(1+(b/(2r_w*))^2)^0.5]				
5	**t_d*/t***		1.3					t*	2bC_D			
6	1.111											
7							Bracketted quantity				26.704	
8	computed from ratio	Le =	26.08	ft								
9	nominal	Le =	25.97	ft			**K_r =**	**9.55E-04 ft/sec**				
10	% difference		0%					**8.25E+01 ft/day**		**2.51E+01 m/day**		
11								**2.91E-02 cm/sec**				
12												
13	**Modulation Factor =**		0.900				**Unconfined - High-K Bouwer and Rice Model**					
14												
15							K_r =	t_d* r_c^2 ln[R_e/r_w*]				
16	**Dimensionless**	**C_D =**		**Adjusted**				t* 2bC_D				
17	**Time**	**1.3**		**Time**								
18	0	1		0			ln(R_e/r_w*)=	2.522		*A* =	2.359	
19	0.1	0.995214		0.0900						*B* =	0.373	
20	0.2	0.981686		0.1800				first term	1.1/(ln((d+b)/r_w*)			
21	0.3	0.96061		0.2700					0.241			
22	0.4	0.933103		0.3600				second term		(*A*+*B**(ln[(B-(d+b))/r_w*]))/(b/r_w*)		
23	0.5	0.900206		0.4500						0.155		
24	0.6	0.862885		0.5400				ln[(B-(d+b))/r_w*]		4.771		
25	0.7	0.822029		0.6300						Cannot exceed 6.		
26	0.8	0.778451		0.7200						See Butler (1997) - p.108.		
27	0.9	0.732893		0.8100								
28	1	0.686021		0.9000			**K_r =**	**7.33E-04 ft/sec**				
29	1.1	0.638435		0.9900				**6.33E+01 ft/day**		**1.93E+01 m/day**		
30	1.2	0.590669		1.0800				**2.24E-02 cm/sec**				


Curve Matching
MW3BR
CD = 1.3
1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50
-7
-2
3
8
13
18
Normalized Head (dimensionless)
Time (seconds)

MW-B5
Rising Head

	L	M	N	O	P	Q	R	S	T	U	V	W
1												
2			**Best Fit**				**Confined - High-K Hvorslev Model**					
3	**Time**		**Type Curve**									
4	**Correlation Ratio**		**C_D**				K_r =	t_d^* r_c^2 ln[b/(2r_w^*)+(1+(b/(2r_w^*))^2)^0.5]				
5	**t_d^*/t^***		0.9					t^*	2bC_D			
6	0.833											
7							Bracketted quantity				26.704	
8	computed from ratio	Le =	46.37	ft								
9	nominal	Le =	61.40	ft			**K_r =**	**1.03E-03 ft/sec**				
10	% difference		24%					**8.94E+01 ft/day**		**2.72E+01 m/day**		
11								**3.15E-02 cm/sec**				
12												
13	**Modulation Factor =**		1.200				**Unconfined - High-K Bouwer and Rice Model**					
14												
15							K_r =	t_d^* r_c^2 ln[R_e/r_w^*]				
16	**Dimensionless**	**C_D =**		**Adjusted**				t^* 2bC_D				
17	**Time**	**0.9**		**Time**								
18	0	1		0			ln(R_e/r_w^*)=	2.808		*A* =	2.359	
19	0.1	0.995151		0.1200						*B* =	0.373	
20	0.2	0.98121		0.2400				first term	1.1/(ln((d+b)/r_w^*)			
21	0.3	0.959093		0.3600					0.210			
22	0.4	0.929716		0.4800				second term		(*A*+*B**(ln[(B-(d+b))/r_w^*]))/(b/r_w^*)		
23	0.5	0.893983		0.6000						0.146		
24	0.6	0.852784		0.7200				ln[(B-(d+b))/r_w^*]		4.152		
25	0.7	0.806982		0.8400						Cannot exceed 6.		
26	0.8	0.757411		0.9600						See Butler (1997) - p.108.		
27	0.9	0.70487		1.0800								
28	1	0.650115		1.2000			**K_r =**	**8.84E-04 ft/sec**				
29	1.1	0.593861		1.3200				**7.64E+01 ft/day**		**2.33E+01 m/day**		
30	1.2	0.536775		1.4400				**2.70E-02 cm/sec**				

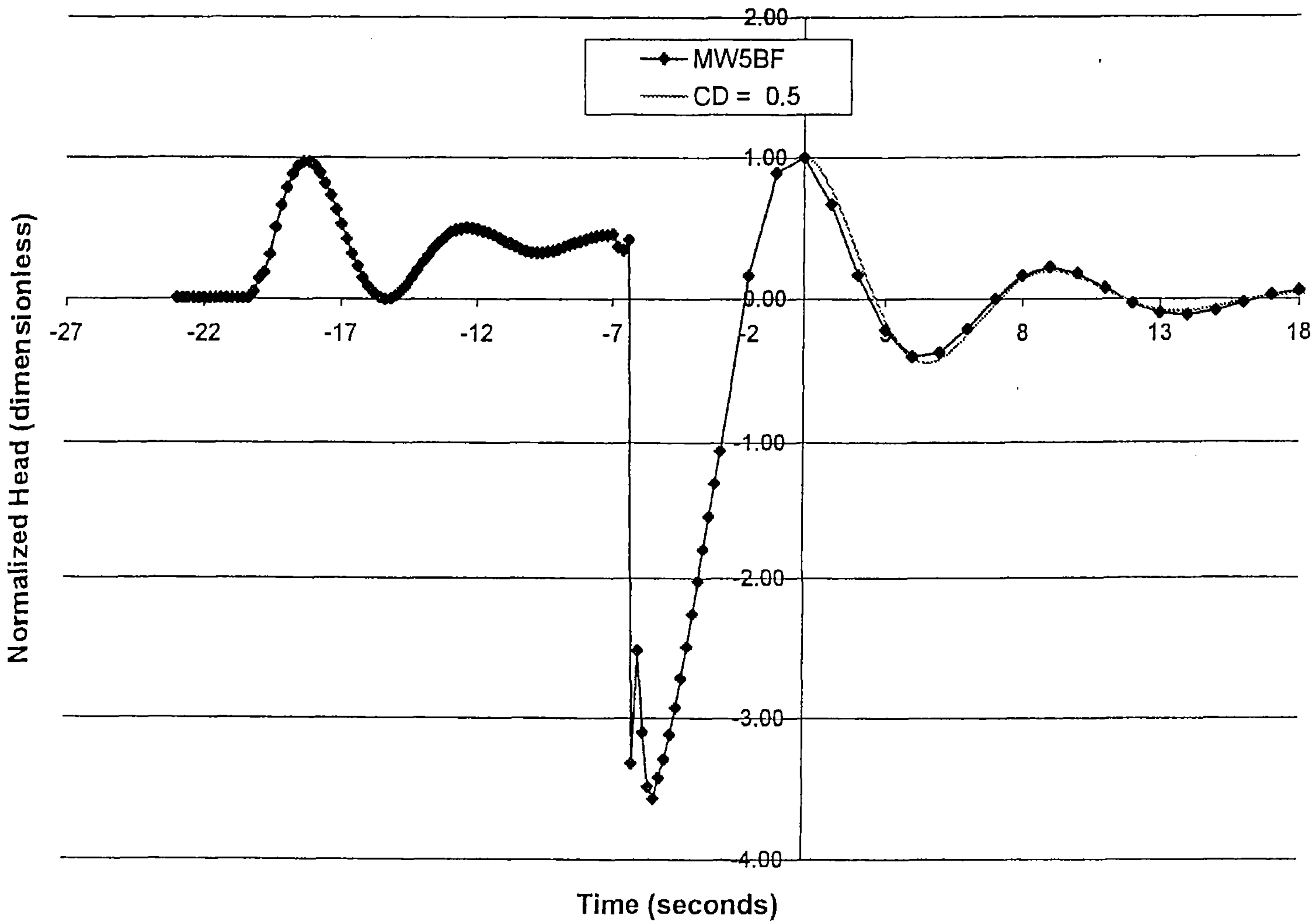
Curve Matching



MW-B5
Falling Head

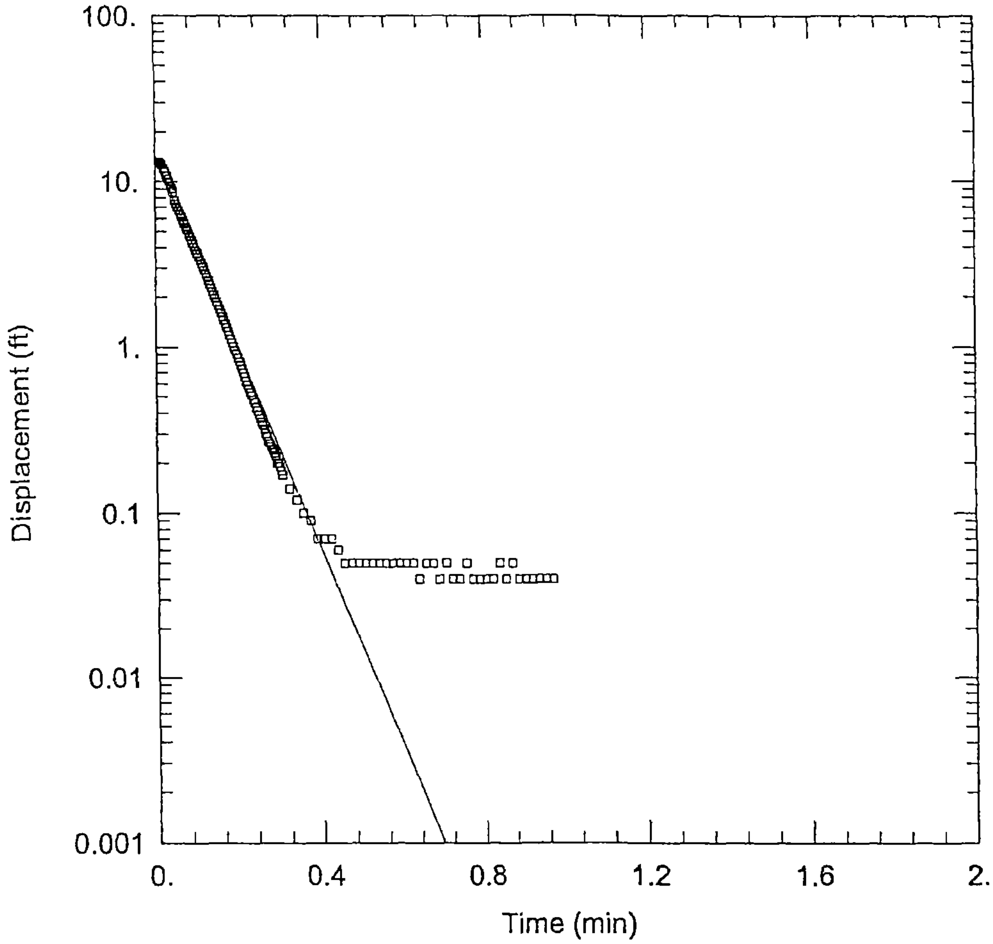
	L	M	N	O	P	Q	R	S	T	U	V	W
1												
2			**Best Fit**				**Confined - High-K Hvorslev Model**					
3	**Time**		**Type Curve**									
4	**Correlation Ratio**		**C_D**				K_r =	t_d* r_c^2 ln[b/(2r_w*)+(1+(b/(2r_w*))^2)^0.5]				
5	**t_d*/t***		0.5					t*	2bC_D			
6	0.714											
7							Bracketted quantity				26.704	
8	computed from ratio	Le =	63.11	ft								
9	nominal	Le =	61.40	ft			**K_r =**	**1.60E-03 ft/sec**				
10	% difference		3%					**1.38E+02 ft/day**		**4.20E+01 m/day**		
11								**4.86E-02 cm/sec**				
12												
13	**Modulation Factor =**		1.400				**Unconfined - High-K Bouwer and Rice Model**					
14												
15							K_r =	t_d* r_c^2 ln[R_e/r_w*]				
16	**Dimensionless**	**C_D =**		**Adjusted**				t* 2bC_D				
17	**Time**	**0.5**		**Time**								
18	0	1		0			ln(R_e/r_w*)=	2.808		***A*** =	2.359	
19	0.1	0.995086		0.1400						***B*** =	0.373	
20	0.2	0.980714		0.2800				first term	1.1/(ln((d+b)/r_w*)			
21	0.3	0.957485		0.4200					0.210			
22	0.4	0.926057		0.5600				second term		(***A*** +***B*** *(ln[(B-(d+b))/r_w*]))/(b/r_w*)		
23	0.5	0.887137		0.7000						0.146		
24	0.6	0.841468		0.8400				ln[(B-(d+b))/r_w*]		4.152		
25	0.7	0.789826		0.9800						Cannot exceed 6.		
26	0.8	0.733005		1.1200						See Butler (1997) - p.108.		
27	0.9	0.671812		1.2600								
28	1	0.607055		1.4000			**K_r =**	**1.36E-03 ft/sec**				
29	1.1	0.53954		1.5400				**1.18E+02 ft/day**		**3.59E+01 m/day**		
30	1.2	0.47006		1.6800				**4.17E-02 cm/sec**				

Curve Matching



ATTACHMENT B

AQTESOLV Plots



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\MWB2R.AQT
Date: 06/26/02 Time: 20:01:25

PROJECT INFORMATION

Company: Earth Tech
Client: Daimler Chrysler
Test Well: MWB2R
Test Date: 5/30/02

AQUIFER DATA

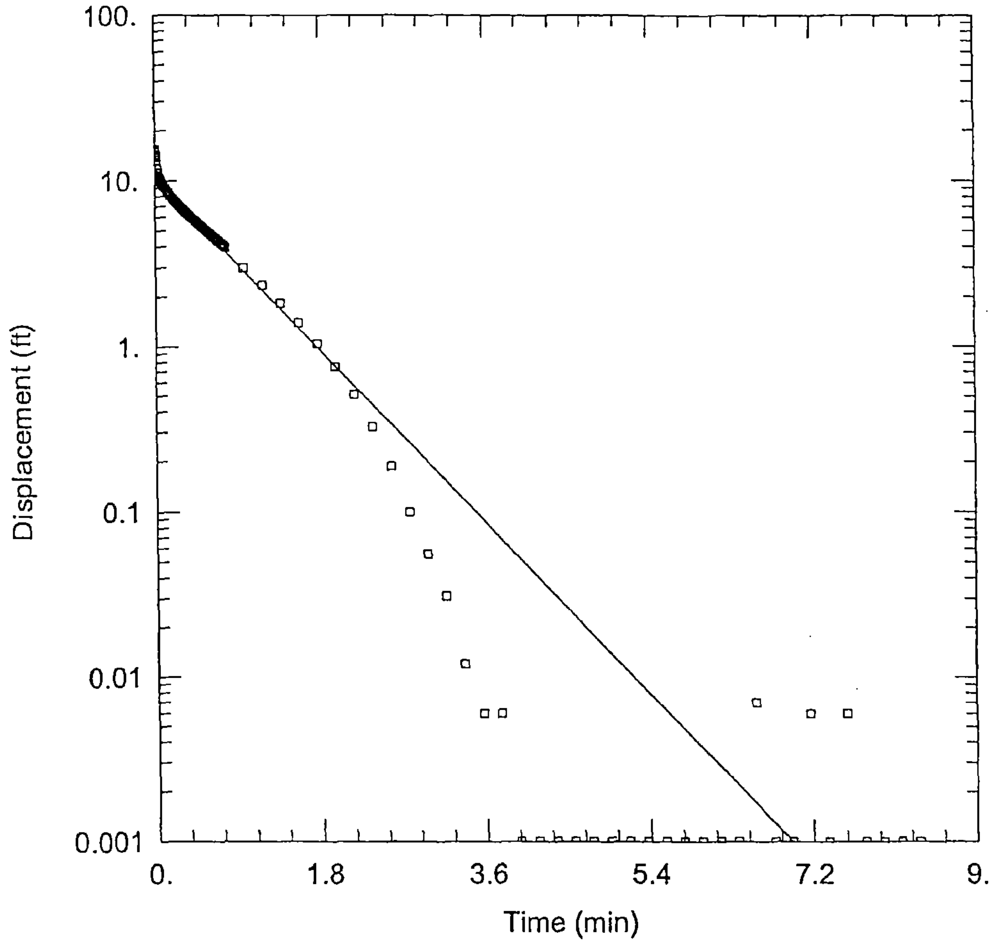
Saturated Thickness: 80. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Initial Displacement: 13.12 ft
Casing Radius: 0.08333 ft
Screen Length: 10. ft
Water Column Height: 67.1 ft
Wellbore Radius: 0.375 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 181.8 ft/day
y0 = 14.92 ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\MWB2F.AQT
Date: 06/26/02 Time: 20:02:06

PROJECT INFORMATION

Company: Earth Tech
Client: Daimler Chrysler
Test Well: MWB2F
Test Date: 5/30/02

AQUIFER DATA

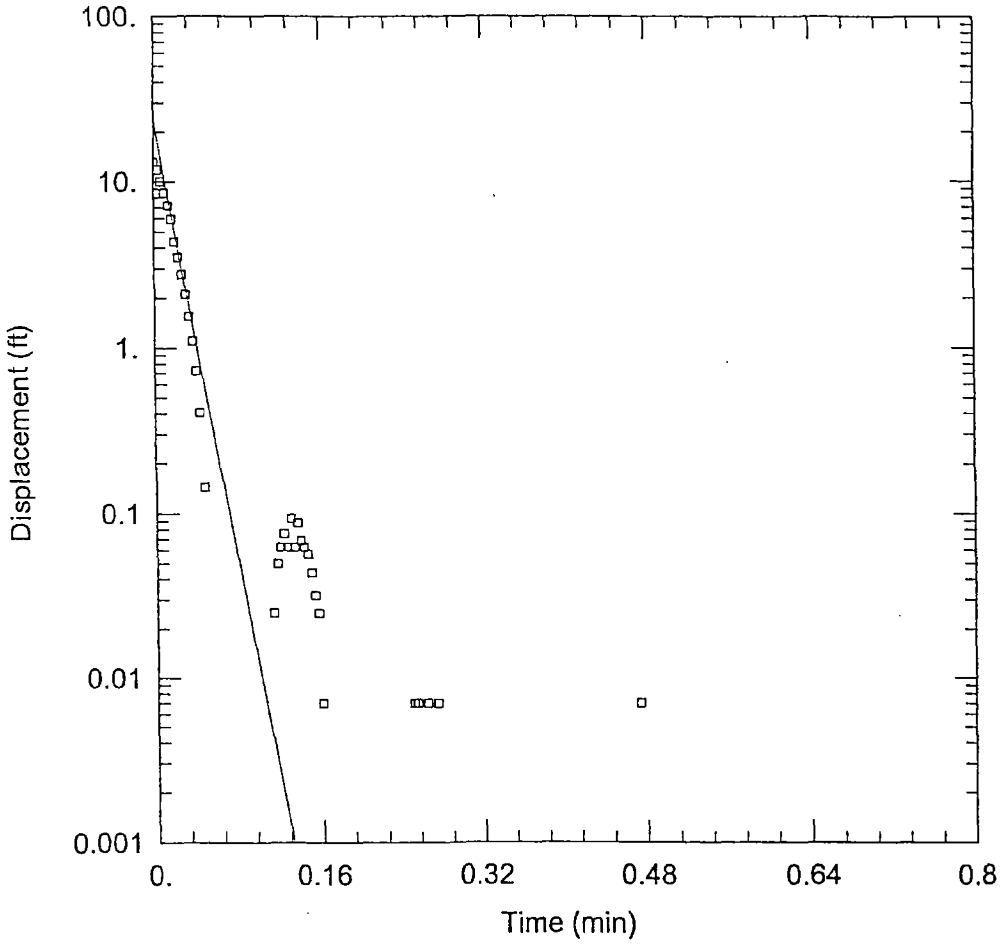
Saturated Thickness: 80. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Initial Displacement: 15.42 ft Water Column Height: 67.1 ft
Casing Radius: 0.08333 ft Wellbore Radius: 0.375 ft
Screen Length: 10. ft Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined $K = 17.47$ ft/day
Solution Method: Bouwer-Rice $y0 = 10.38$ ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\MWB3R.AQT
Date: 06/26/02 Time: 20:03:05

PROJECT INFORMATION

Company: Earth Tech
Client: Daimler Chrysler
Test Well: MWB3R
Test Date: 5/30/02

AQUIFER DATA

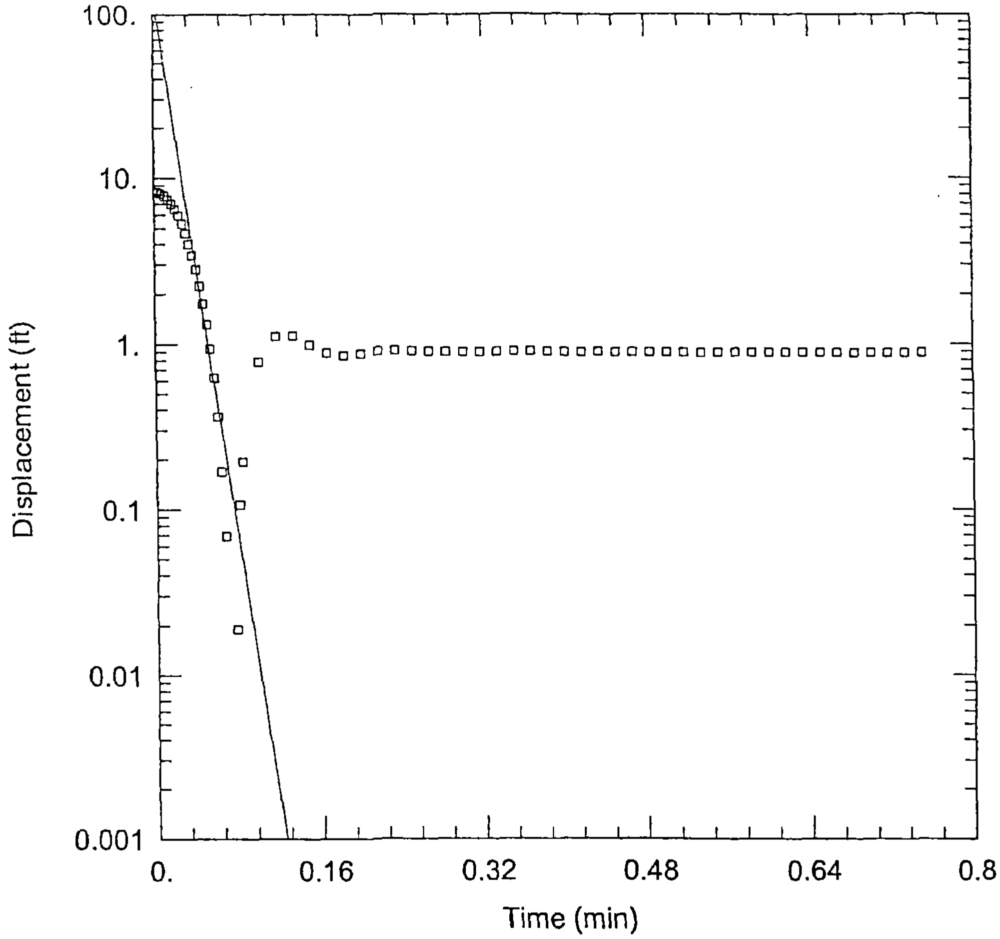
Saturated Thickness: 80. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Initial Displacement: 13.15 ft Water Column Height: 35.73 ft
Casing Radius: 0.08333 ft Wellbore Radius: 0.375 ft
Screen Length: 10. ft Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined K = 908.7 ft/day
Solution Method: Bouwer-Rice y0 = 23.71 ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\MWB3F.AQT
Date: 06/26/02 Time: 20:02:47

PROJECT INFORMATION

Company: Earth Tech
Client: Daimler Chrysler
Test Well: MWB3F
Test Date: 5/30/02

V | h = 1/10

AQUIFER DATA

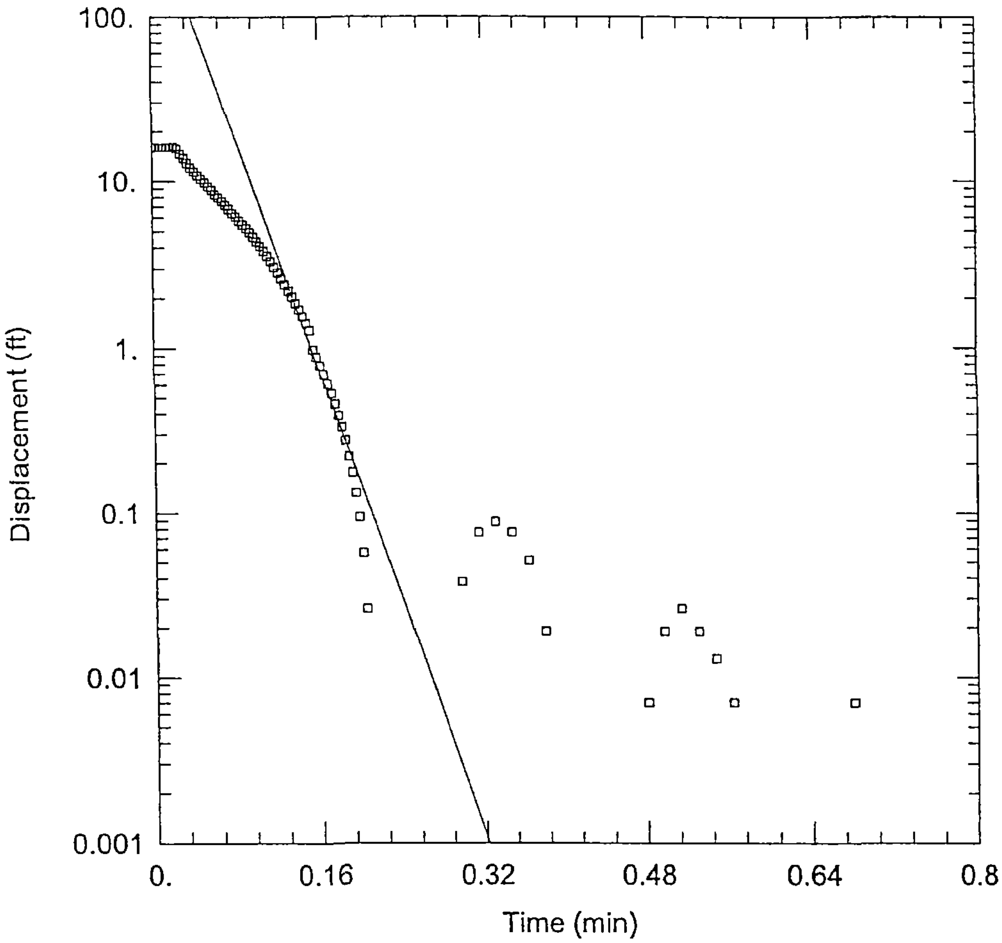
Saturated Thickness: 80. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Initial Displacement: 8.283 ft
Water Column Height: 35.73 ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.375 ft
Screen Length: 10. ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
K = 1135.8 ft/day
Solution Method: Bouwer-Rice
y0 = 137.7 ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\MWC1R.AQT
Date: 06/26/02 Time: 19:26:22

PROJECT INFORMATION

Company: Earth Tech
Client: Daimler Chrysler
Test Well: MWC1R
Test Date: 5/30/02

AQUIFER DATA

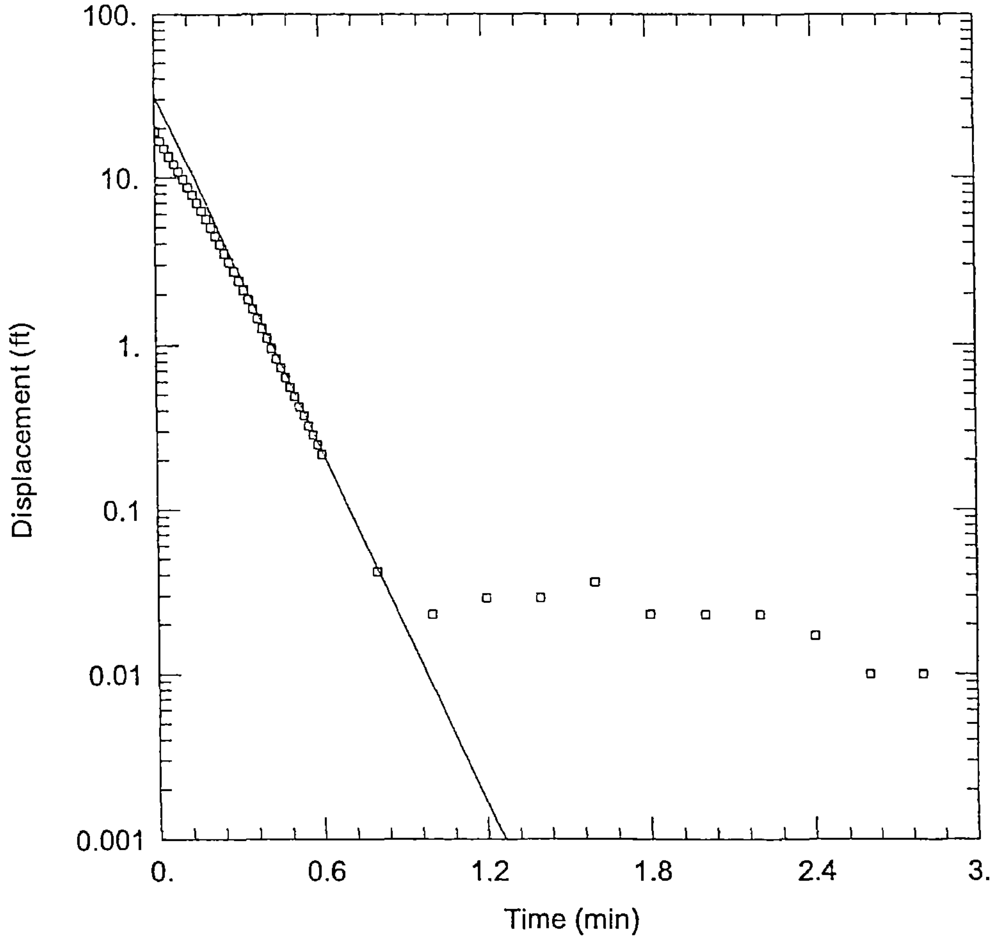
Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Initial Displacement: 16.07 ft
Casing Radius: 0.08333 ft
Screen Length: 10. ft
Water Column Height: 95.07 ft
Wellbore Radius: 0.375 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 569.2 ft/day
y0 = 468. ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\MWC2F.AQT
Date: 06/26/02 Time: 19:26:53

PROJECT INFORMATION

Company: Earth Tech
Client: Daimler Chrysler
Test Well: MWC2F
Test Date: 5/30/02

AQUIFER DATA

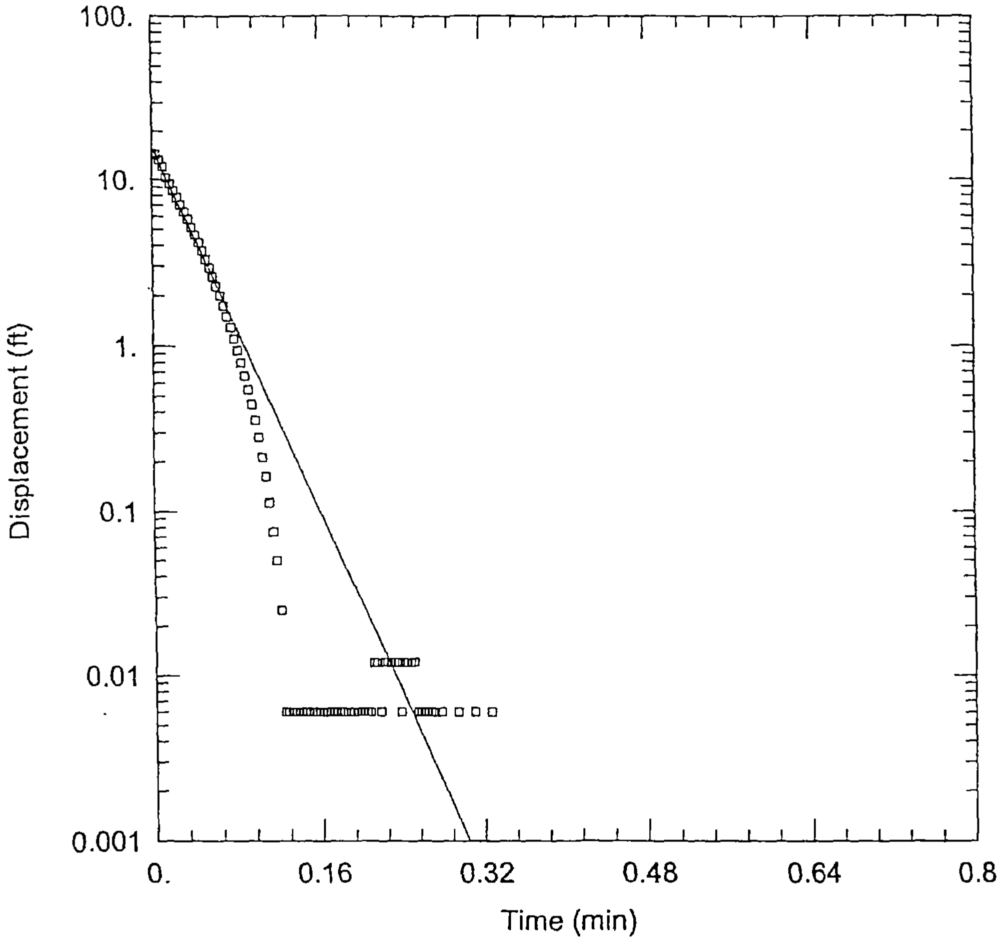
Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Initial Displacement: 19.17 ft
Casing Radius: 0.08333 ft
Screen Length: 10. ft
Water Column Height: 89.65 ft
Wellbore Radius: 0.375 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 112. ft/day
y0 = 31.79 ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\PZ7IR.AQT
Date: 06/26/02 Time: 20:04:07

PROJECT INFORMATION

Company: Earth Tech
Client: Daimler Chrysler
Test Well: PZ7IR
Test Date: 5/30/02

AQUIFER DATA

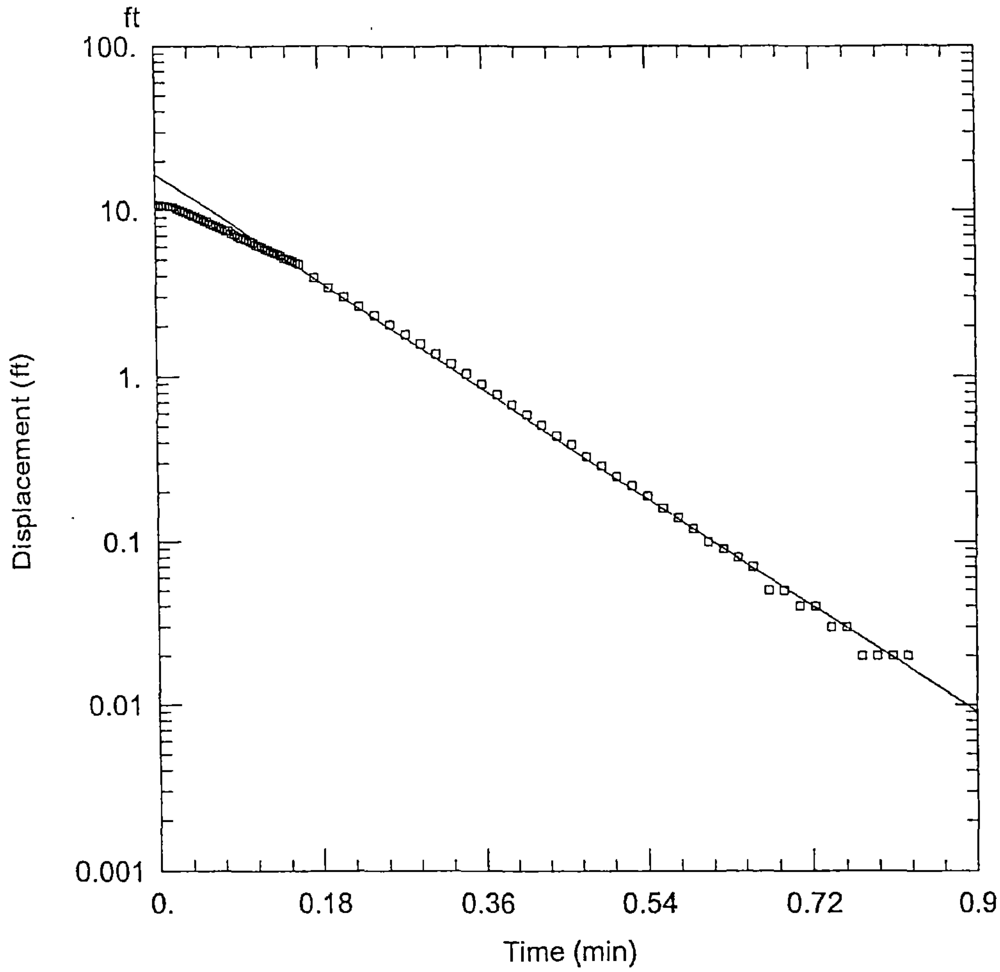
Saturated Thickness: 80. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Initial Displacement: 14.53 ft
Casing Radius: 0.08333 ft
Screen Length: 2. ft
Water Column Height: 36.42 ft
Wellbore Radius: 0.375 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1267.1 ft/day
y0 = 15.88 ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\MWC2R.AQT
Date: 06/26/02 Time: 19:27:17

PROJECT INFORMATION

Company: Earth Tech
Client: Daimler Chrysler
Test Well: MWC2R
Test Date: 5/30/02

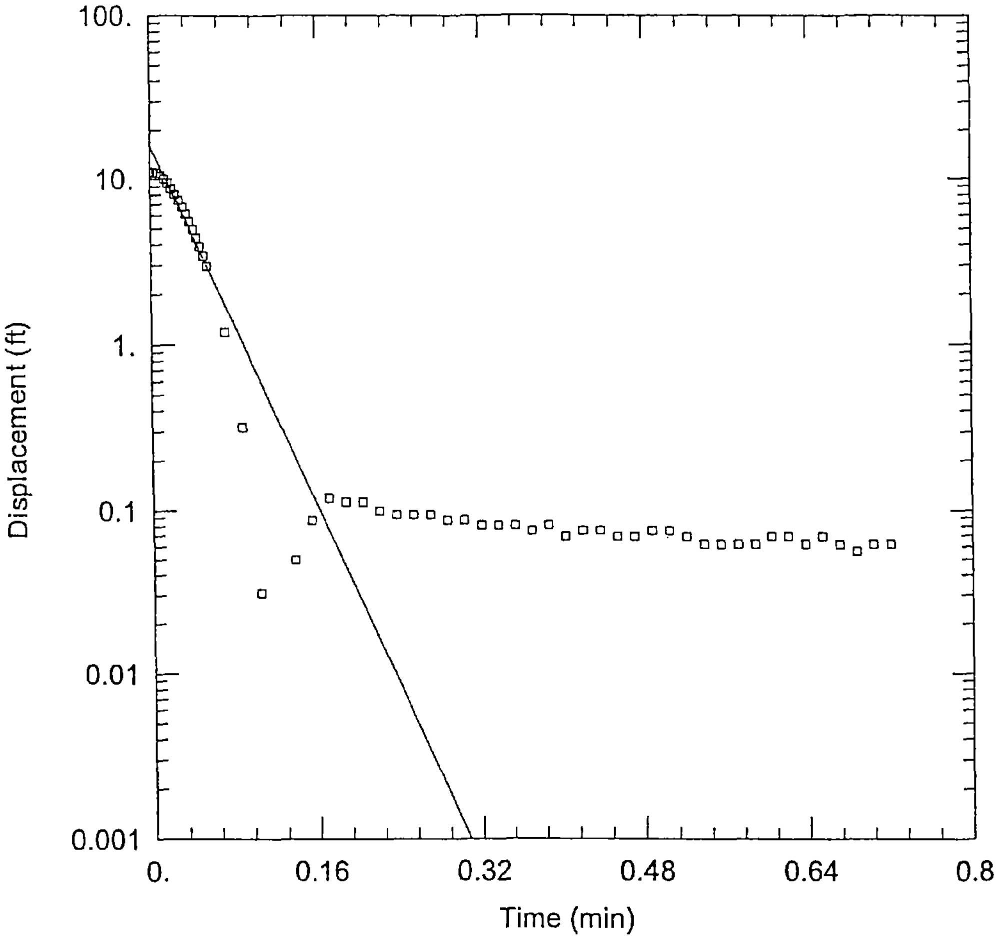
AQUIFER DATA

Saturated Thickness: 100. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Initial Displacement: 10.75 ft Water Column Height: 89.65 ft
Screen Length: 10. ft333 Gravel Pack Porosity: 0.3

Solution Method: Bouwer-Rice SOLUT y0 = 16.6 ft ft/day



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\PZ7IF.AQT
Date: 06/26/02 Time: 19:27:48

PROJECT INFORMATION

Company: Earth Tech
Client: Daimler Chrysler
Test Well: PZ7IF
Test Date: 5/30/02

AQUIFER DATA

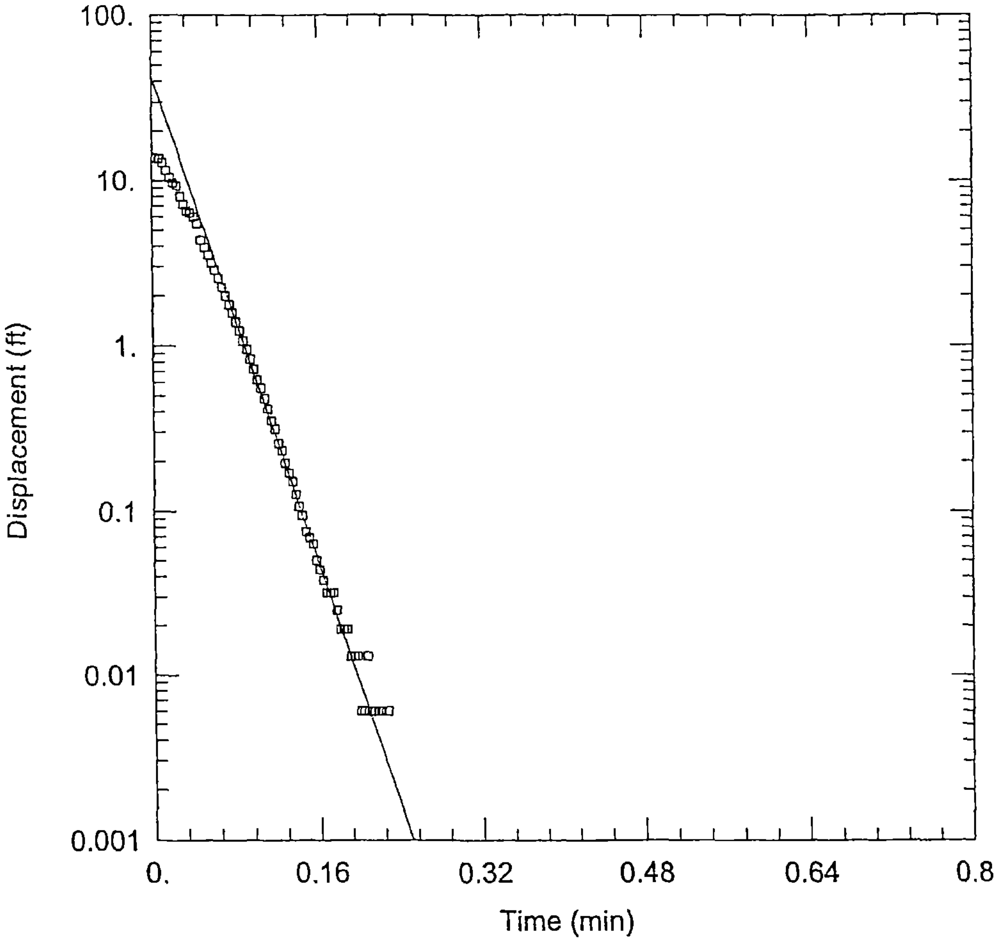
Saturated Thickness: 80. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Initial Displacement: 11.06 ft
Casing Radius: 0.08333 ft
Screen Length: 2. ft
Water Column Height: 36.42 ft
Wellbore Radius: 0.375 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1254.9 ft/day
y0 = 16.19 ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\PZ8IR.AQT
Date: 06/26/02 Time: 20:04:38

PROJECT INFORMATION

Company: Earth Tech
Client: Daimler Chrysler
Test Well: PZ8IR
Test Date: 5/30/02

AQUIFER DATA

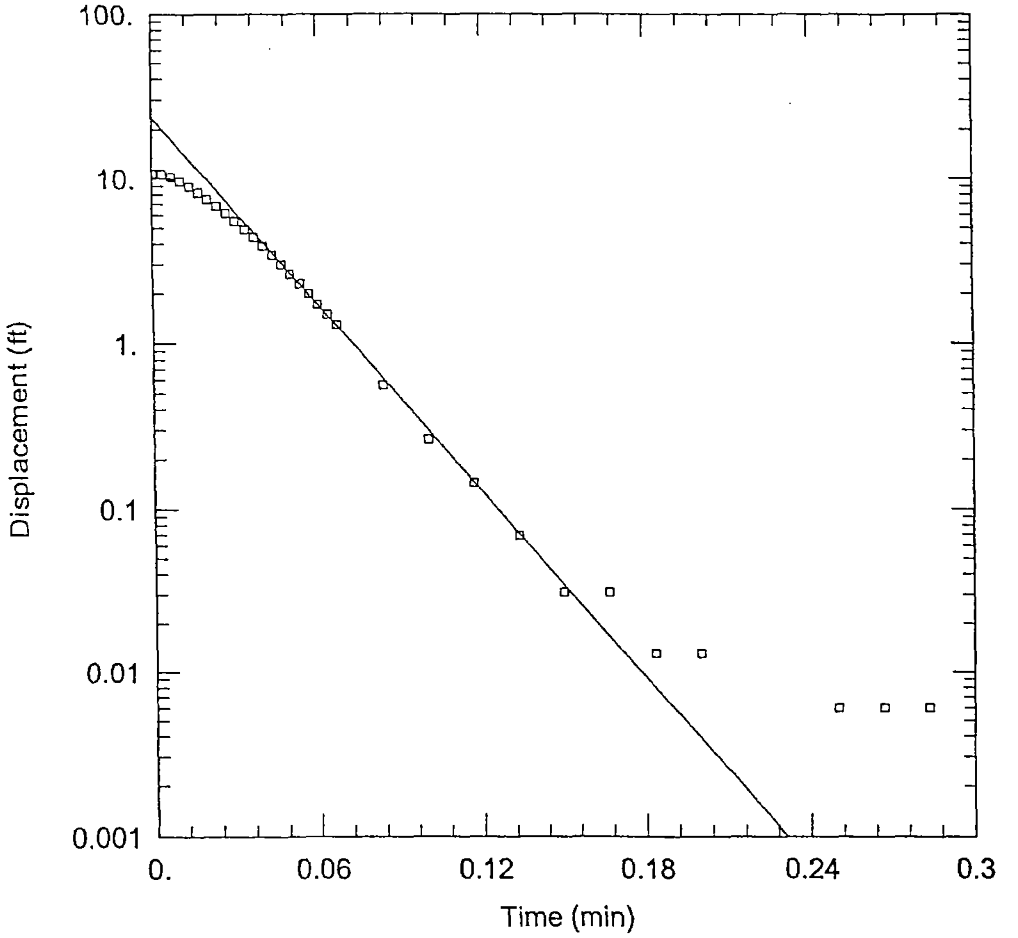
Saturated Thickness: 80. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Initial Displacement: 13.8 ft
Casing Radius: 0.08333 ft
Screen Length: 2. ft
Water Column Height: 19.31 ft
Wellbore Radius: 0.375 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1601.8 ft/day
y0 = 43.08 ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\PZ8IF.AQT
Date: 06/26/02 Time: 19:28:53

PROJECT INFORMATION

Company: Earth Tech
Client: Daimler Chrysler
Test Well: PZ8IF
Test Date: 5/30/02

AQUIFER DATA

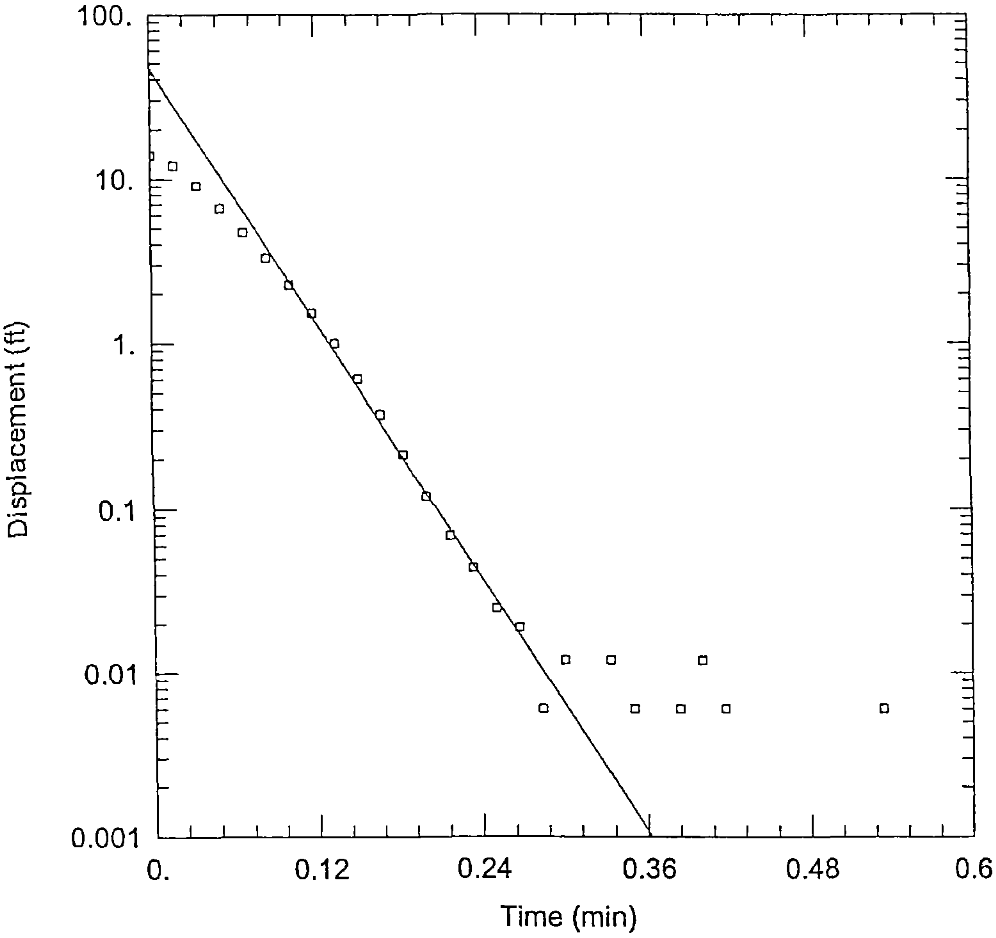
Saturated Thickness: 80. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Initial Displacement: 10.72 ft
Casing Radius: 0.08333 ft
Screen Length: 2. ft
Water Column Height: 19.31 ft
Wellbore Radius: 0.375 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1636.4 ft/day
y0 = 23.64 ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\PZ8DF.AQT
Date: 06/26/02 Time: 19:29:11

PROJECT INFORMATION

Company: Earth Tech
Client: Daimler Chrysler
Test Well: PZ8DF
Test Date: 5/30/02

AQUIFER DATA

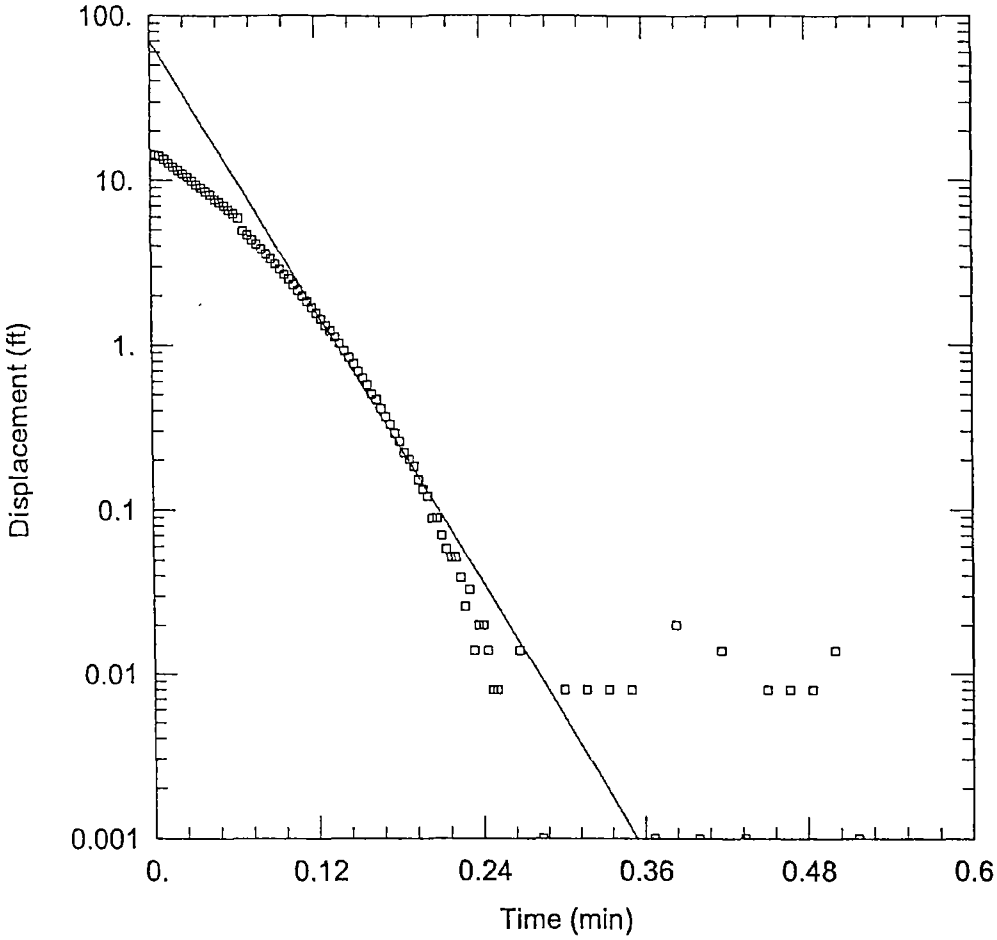
Saturated Thickness: 80. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Initial Displacement: 13.93 ft Water Column Height: 60.49 ft
Casing Radius: 0.08333 ft Wellbore Radius: 0.375 ft
Screen Length: 2. ft Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined K = 1273.1 ft/day
Solution Method: Bouwer-Rice y0 = 46.57 ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\PZ8DR.AQT
Date: 06/26/02 Time: 19:29:26

PROJECT INFORMATION

Company: Earth Tech
Client: Daimler Chrysler
Test Well: PZ8DR
Test Date: 5/30/02

AQUIFER DATA

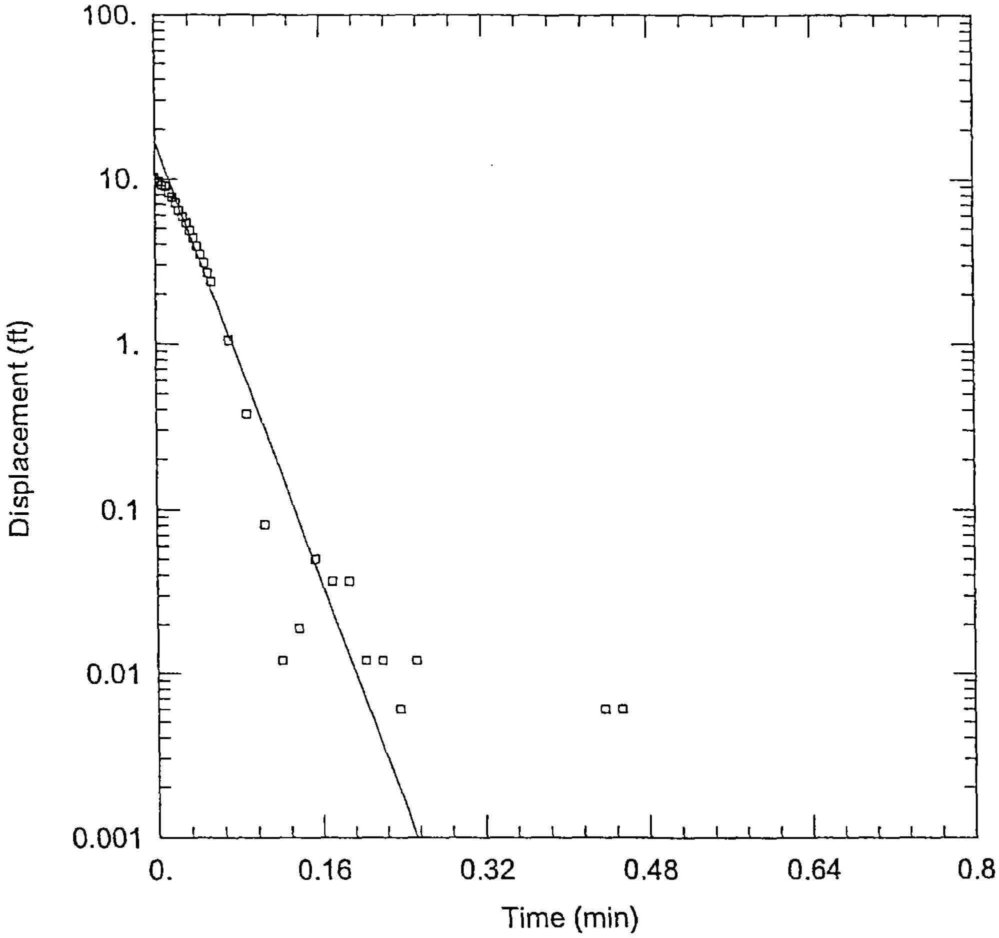
Saturated Thickness: 80. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Initial Displacement: 14.33 ft
Casing Radius: 0.08333 ft
Screen Length: 2. ft
Water Column Height: 60.49 ft
Wellbore Radius: 0.375 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1354.3 ft/day
y0 = 70.83 ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\PZ16DF.AQT
Date: 06/26/02 Time: 19:30:21

PROJECT INFORMATION

Company: Earth Tech
Client: Daimler Chrysler
Test Well: PZ16DF
Test Date: 5/30/02

AQUIFER DATA

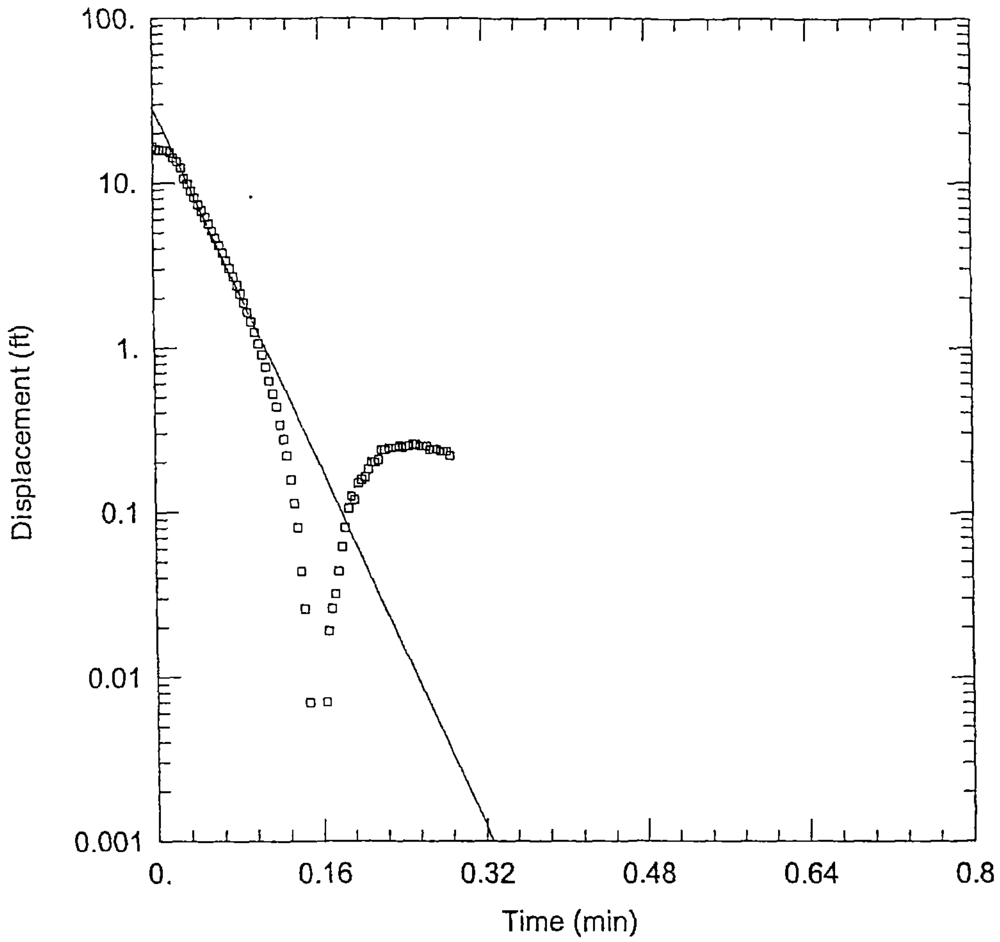
Saturated Thickness: 85. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Initial Displacement: 10.04 ft
Casing Radius: 0.08333 ft
Screen Length: 4. ft
Water Column Height: 63.64 ft
Wellbore Radius: 0.375 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1031.5 ft/day
y0 = 16.68 ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\PZ16DR.AQT
Date: 06/26/02 Time: 19:30:41

PROJECT INFORMATION

Company: Earth Tech
Client: Daimler Chrysler
Test Well: PZ16DR
Test Date: 5/30/02

AQUIFER DATA

Saturated Thickness: 85. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Initial Displacement: 16.57 ft
Casing Radius: 0.08333 ft
Screen Length: 4. ft
Water Column Height: 63.64 ft
Wellbore Radius: 0.375 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 844. ft/day
y0 = 28.65 ft

Appendix B - Geochemistry Technical Memorandum

TECH MEMO

Date: July 3, 2002

To: Rob Stenson, Earth Tech
Gary Stanczuk, DaimlerChrysler

From: Paul Barnes

Subject: **Assessment of the Potential for Enhancing Natural Attenuation Processes Dayton Thermal Products Facility Dayton, Ohio**

Introduction

This technical memorandum is intended to assess the potential for applying enhanced natural attenuation principles to the treatment of groundwater contaminated by tetrachloroethylene (PCE) and trichloroethylene (TCE) at the Dayton Thermal Products facility. In general, TCE contamination at the site is widespread and varies greatly in concentration while the area of PCE concentration is smaller and always co-located with TCE contamination.

Natural attenuation of TCE contamination by either aerobic cometabolism or reductive dechlorination processes is possible at some sites. Since TCE itself is a poor substrate for microbial growth, aerobic cometabolism is generally possible only in the presence of an aerobically degradable substance that allows the growth of organisms that produce a group of enzymes called monooxygenases (MOs), that can begin the degradation process by cleaving the recalcitrant TCE molecule into smaller, more degradable products. These degradation products are many and generally non-persistent, so naturally occurring aerobic cometabloism is difficult to measure directly but this type of spontaneous aerobic cometabolism has been observed on sites where co-contamination with biodegradable compounds like light petroleum hydrocarbons exists.

Reductive dechlorination, the other potential process, must also be facilitated by the presence of another readily biodegradable substrate but reductive dechlorination occurs only under anaerobic and reducing conditions. This process produces a distinct pathway of sequential dechlorination through cis-1,2-dichloroethylene (cis-DCE), vinyl chloride, and ethene, intermediates that sometimes persist long enough to be measured as evidence of reductive dechlorination. Naturally occurring reductive dechlorination is possible in the presence of a significant input of biodegradable substrate combined with persistent reducing conditions.

Either process can be initiated and/or enhanced in most aquifers, depending upon geochemical and hydraulic conditions.

PCE is less amenable to biological treatment overall and aerobic cometabolism by indigenous organisms is not generally possible. PCE must typically be addressed by reductive dechlorination, at least to remove the first chlorine and produce TCE.

Data Evaluation

To determine if any natural attenuation is occurring or has the potential to be enhanced, evaluations of historical contaminant and water level data, and newly collected transformation product and geochemistry data were conducted. This evaluation consisted of reconstructing and correlating trends in contamination and water table elevation over time, as well as considering geochemical interactions and nutrient availability.

Geochemistry

With respect to overall geochemistry, the aquifer exhibits relatively low dissolved oxygen (<1.0 mg/L) in the most contaminated (shallow) zone, which lends itself to an anaerobic approach such as reductive dechlorination. Competing electron acceptors for reductive dechlorination in the forms of iron, manganese, nitrate, and sulfate are present but in relatively low concentrations, suggesting that contaminants could be addressed efficiently without using excess substrate. pH and alkalinity are also well within reasonable working ranges and the predominance of ferrous iron over ferric iron suggests that the overall redox is at least mildly reducing. In all, geochemical conditions are amenable to a reductive dechlorination approach. Additionally, the concentrations of other electron acceptors such as ferric iron, manganese, nitrate and sulfate are clearly lower in wells where some dechlorination is indicated, confirming that reducing conditions can be developed in the redox range necessary for the reductive dechlorination process to proceed.

Evidence of Existing Dechlorination Activity

In general, while evidence of partial reductive dechlorination is present at some locations, there is substantial heterogeneity in contaminant dynamics across the site. Conditions appear to range from no apparent evidence of attenuation to very significant production of cis-DCE, an indication of reductive dechlorination. Even in locations where the production of cis-DCE is obvious, however, there is little evidence of further dechlorination to vinyl chloride and ethene and the total contaminant mass is relatively unaffected. Fluctuations up to 6 feet in groundwater elevation further confound the evaluation of attenuation because there appears to be some correlation between groundwater elevation and contaminant concentration at many locations. Additionally, there is no substantial evidence of a potential electron donor for reductive dechlorination, though there is some history of petroleum LNAPL releases in some areas and some low concentrations of total organic carbon (TOC) were measurable, though neither could be specifically correlated to observed dechlorination.

To address the difficulties of interpretation, we have selected some individual wells for detailed and separate evaluation. All were selected from the group that was recently re-sampled and they appear to represent the range of site conditions fairly well.

In general, most of the shallow wells that contain PCE or TCE also exhibit some evidence of current or historical dechlorination activity. Specifically, MW008S, MW018S, MWA002, MWA005, MWA006, PZ-012I, and PZ-013I (from among the re-sampled set) showed significant concentrations of the TCE reductive dechlorination product cis-DCE. MWA002, MWA006 and PZ-012I are discussed individually below as examples.

Well ID	Summary of Results & Interpretation
MWA002 Depth: 40’	MWA002 (Figure 1) has historically had high PCE concentrations that may be positively correlated to water level. Moderate TCE concentrations may also have been correlated to water level until February of 2000, but have not rebounded from a concentration minimum (for the period considered) observed at that time. Relatively high cis-DCE concentrations were observed beginning in January 1998 and seem to be correlated to, but lagging PCE/TCE concentration change events. This significant reductive dechlorination may account for the continued decline of TCE concentrations despite increasing water levels and the corresponding increasing PCE concentration. Since 1 ug/L TCE should be dechlorinated to produce only 0.73 ug/L cis-DCE, the very high DCE concentrations observed in July and October of 1999, exceeding both the PCE and TCE concentrations, may indicate some significant dechlorination of PCE as well. This cannot be verified from the available data as groundwater elevation changes may also explain the decrease in PCE, however the PCE concentration in MWA002 has not fully rebounded to previous concentrations as groundwater elevations have returned to previous levels. MWA002 also provides some indication that the microbial population may be able to facilitate degradation beyond cis-DCE, although no vinyl chloride was observed. Peak cis-DCE concentrations did not persist, but the mechanism for its removal is unclear based upon the available data. Further evidence of biological reduction is given by concentrations of nitrate (.047(J) mg/L), and sulfate (35.3 mg/L) that are much lower than the apparent background concentrations which are probably between 2 and 6 mg/L for nitrate and between 80 and 150 mg/L for sulfate. Stimulation of reductive dechlorination in this area should be feasible, but nitrogen nutrient supplementation for bacteria stimulation may also be necessary.

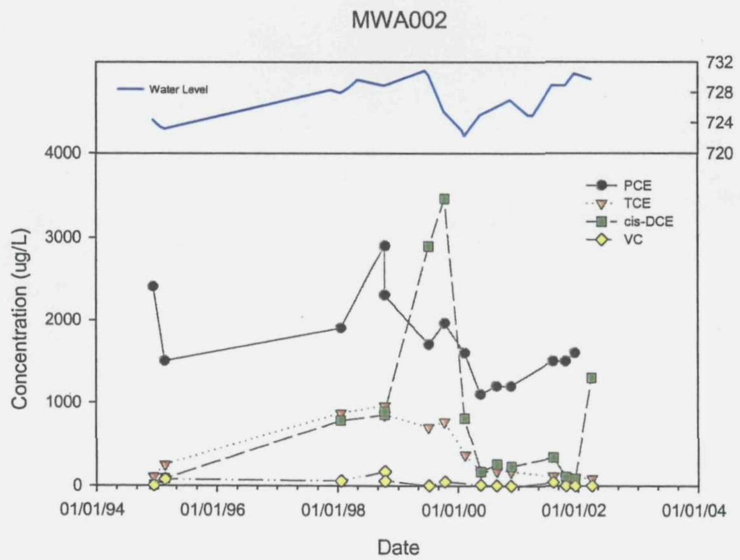


Figure 1: MWA002

Well ID	Summary of Results & Interpretation
MWA006 Depth: 40'	MWA006 (Figure 2) has historically shown TCE concentrations in the 1,500 to 2,000 ug/L range that may also be correlated with groundwater elevation. A groundwater elevation low around January of 2000 corresponded to a TCE concentration low, but also with the initiation of some apparent dechlorinating activity that has continued since then. This new level of activity has apparently produced a recent sharp decline in TCE concentration and a corresponding increase in cis-DCE. Nitrate and sulfate concentrations remain relatively high and may be facilitating the process without limitation at this stage, however significant concentrations of TCE and DCE are still present. Enhancement of reductive dechlorination in this area may be possible but would likely require some nitrogen supplementation. Also, it is not clear at this point why vinyl chloride has not been observed but it may be that the high concentrations of TCE favor the kinetics of the first dechlorination step over the subsequent ones.

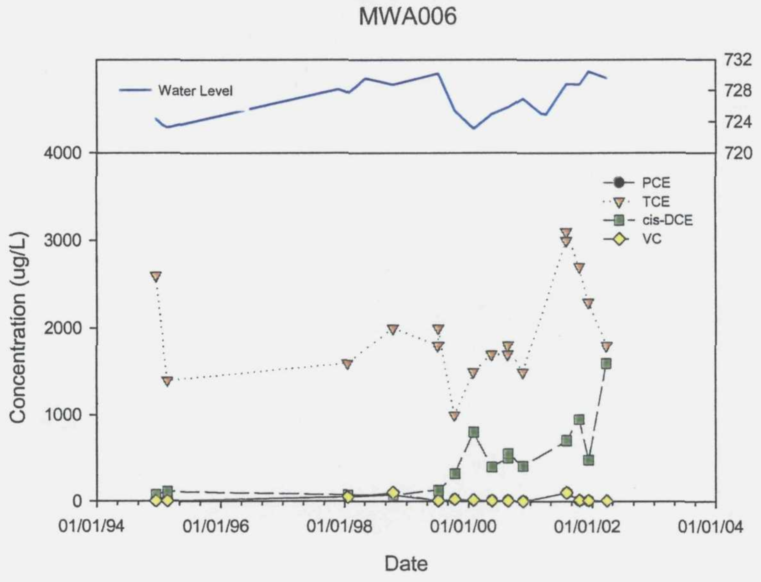


Figure 2: MWA006

Well ID	Summary of Results & Interpretation
PZ012I Depth: 60'	PZ012I (Figure 3) is different form MWs 002 and 006 in that its contamination profile does not seem to be immediately correlated to groundwater elevation. This is interesting and suggests that the shallow groundwater may be periodically in contact with non-dissolved contaminants in the vadose zone or capillary fringe when water levels change, while deeper groundwater received contaminant input through diffusion from above. PZ012I has shown TCE concentrations as high as 2,000 ug/L, which appeared as a maximum in October 1998. Shortly after this maximum was observed the DCE concentration peaked at around 1,500 ug/L, falling back to and persisting at approximately 500 ug/L since then. After reaching its peak, the TCE concentration declined to levels around 100 ug/L and have persisted in that range. Since the peak TCE concentration does not seem to be associated with a particular hydrologic event it is unclear whether the peak TCE concentration in this area represents a real continuing source or a single release event, however it is clear that additional enhancement will be needed to reach MCLs in this area, as well as to remove the accumulated cis-DCE. Nitrogen has been depleted in this area and may be limiting the capacity for further dechlorinating activity.

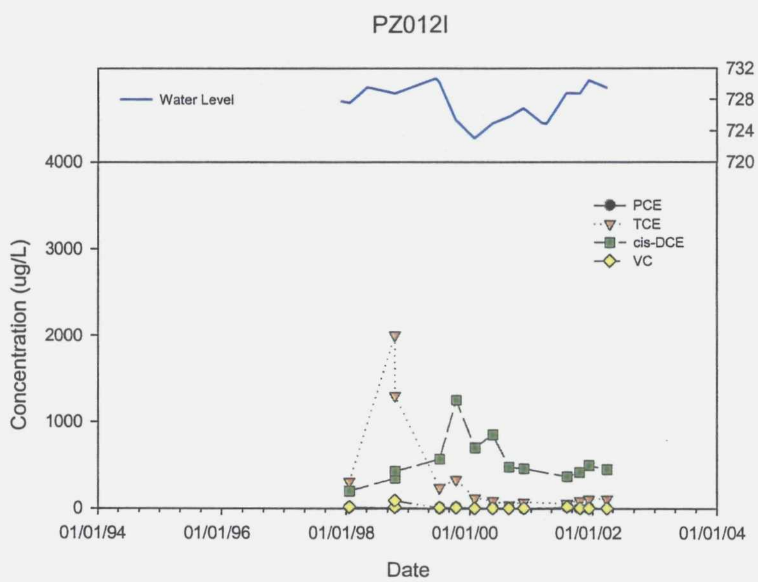


Figure 3: PZ012I

Two of the wells surveyed contained significant contamination but little or no evidence of dechlorination. PZ008I, near an apparently significant source area, and PZ037I, off-site and well separated from the primary release areas.

Well ID	Summary of Results & Interpretation
PZ008I Depth: 40'	Unlike the wells discussed above, there is very little evidence of dechlorination in PZ008I (Figure 4) despite very high concentrations of both PCE and TCE. Contaminant concentrations are not as well correlated to groundwater elevation in this area, possibly due to a much larger source of continuing contamination in the area. Nitrogen appears to be depleted here as well which may explain the lack of cis-DCE as the partial dechlorination of TCE does produce cis-DCE, but the partial dechlorination of PCE only produces more TCE. Any dechlorination potential expended on PCE in the area of PZ008I would therefore have contributed to the apparent TCE contamination and the concentrations are so high that the resulting increase in TCE concentration would likely be indistinguishable. Enhancement of reductive dechlorination in this area may be possible, but will require a large quantity of substrate and may require supplementation of nitrogen.

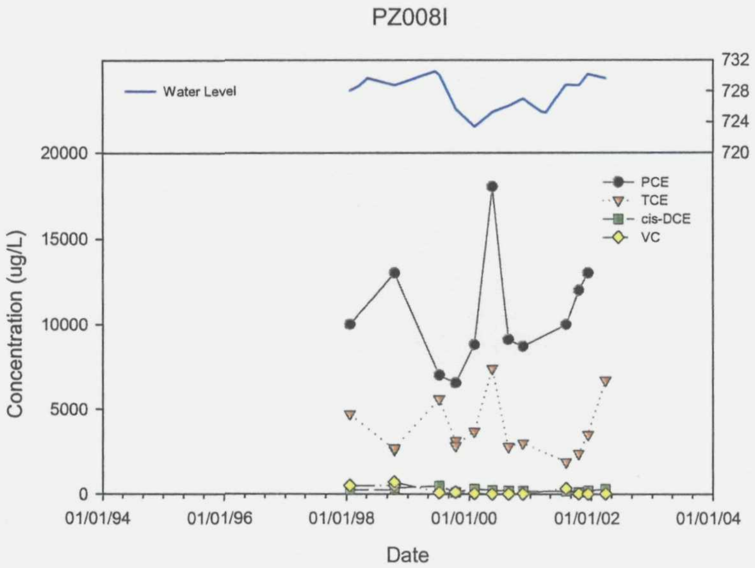


Figure 4: PZ008I

Well ID	Summary of Results & Interpretation
PZ037I Depth: 48'	No evidence of dechlorination is present in PZ037I despite TCE concentrations in the 4,000 ug/L range. Since little historical data from this location is available, no evaluation of trends can be made but, in the recent re-sample event, no available nitrogen was detected, which may suggest that nitrogen limitation prevents reductive dechlorination in that area.

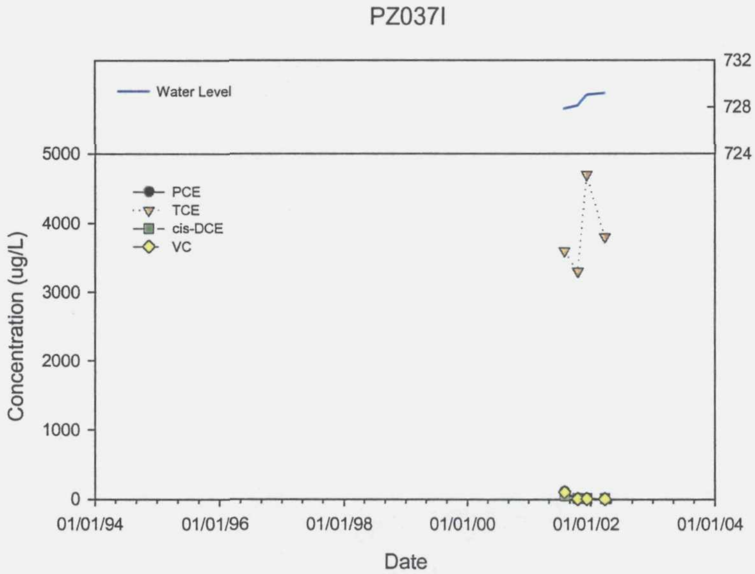


Figure 5: PZ037I

Technology Alternatives

The three primary classes of in-situ technology for remediation of groundwater contaminated by chlorinated solvents are enhanced bioremediation (subclasses discussed earlier), air sparging, and chemical oxidation. Air sparging will not be considered here as the infrastructure requirements and site logistical issues make it an undesirable option if others are available.

Chemical oxidation, consisting of the injection of a strong oxidant such as potassium permanganate, Fenton's reagent (hydrogen peroxide and ferrous iron), or ozone has been shown to be effective on chlorinated solvent contamination at some sites. The quantity of groundwater to be treated suggests that ozone treatment would be cost-prohibitive in this case and site geochemistry is less favorable for permanganate and Fenton's oxidation than might be the case at other sites. Both oxidants are most effective at low pH, as low as 4.0 to 4.5 for Fenton's reagent, which would require a substantial pH adjustment from the 6.0 to 7.8 range measured by Earth Tech. The pH adjustment would be complicated by a high natural buffer capacity. The aquifer's high alkalinity would also consume a substantial amount of any oxidant introduced, as would the naturally occurring organic matter. Other mitigating factors at this site might include the ability to deliver oxidant effectively directly to areas beneath structures and the safe handling of the large quantity of oxidant that would be needed.

In addition to these issues, Earth Tech believes chemical oxidation to be less appealing than reductive dechlorination because PCE and TCE are fundamentally recalcitrant under aerobic and mildly oxidizing conditions (without cometabolic enhancement). This suggests that any failure to completely remove contaminants by chemical oxidation would only leave the residuals in an environment that has already been shown to allow them to persist. The only solution in this case would be repeated attempts at oxidation until success is achieved which is complicated by access limitations. Alternatively, the reductive dechlorination method may also support downgradient cometabolism under aerobic conditions, and it produces degradation products that are known to be aerobically degradable. So, only the first-step dechlorination of the PCE component is required to eliminate the recalcitrant properties of the system. Once this is accomplished, even if reducing conditions were disrupted, there would still remain a possibility of degrading the remaining contaminants by another mechanism such as aerobic cometabolism (TCE) and simple aerobic heterotrophic degradation (vinyl chloride, ethene, ethane) which might be possible without any additional manipulation.

Because some difficulty in affecting in situ treatment can be expected at this type of site and because there is evidence of some naturally occurring capacity for reductive dechlorination, Earth Tech proposes the reductive dechlorination approach as a more cost-effective and logistically manageable alternative. Additionally, the reductive dechlorination technology can easily be combined with the hydraulic control system for delivery of enhancements in-situ, offering an alternative to a technology such as chemical oxidation that requires a more widespread and intrusive application of reagents.

Conclusions

The available data suggests that both groundwater geochemistry and the native microbial population are suitable for at least some reductive dechlorination to occur with additional enhancement. Potential limitations seem to include a lack of available nitrogen and, possibly, a reluctance to move beyond cis-DCE. Supplementing inorganic nitrogen along with the addition of reductive dechlorination substrate can easily address nitrogen limitation and would not be excessively costly. Facilitating dechlorination beyond cis-DCE should also be possible, if more difficult, because cases of genuine limitation in this area are rare. It is more likely that the limited pool of available nitrogen, combined with limited available carbon substrate and the relatively high contaminant concentrations result in a stoichiometric limitation that halts microbial growth before the subsequent dechlorination steps can occur extensively enough to be measured.

Given all of this, Earth Tech would tentatively propose a reductive dechlorination approach for this site, contingent upon some additional pre-design testing to verify the microbial capacity of the system to complete the dechlorination process, as well as to evaluate the extent of nutritional stress imposed by the apparent lack of available nitrogen. Specific recommendations for additional work are described in the next section.

In general, the proposed approach would fit well with any hydraulic containment approach that may be necessary to halt or reverse contaminant migration, especially if such a system includes re-injection. Implementation in a recovery and re-injection configuration would allow substantial optimization of the process for type and quantity of substrate used, supplementation of other nutrients, or even re-distribution of microbial populations from areas of good activity to areas requiring more enhancement.

Recommendations for Additional Testing and Conceptual Approach

In order to address the potential limitations identified above, Earth Tech proposes a combination of microbiological assessment and simple microcosm studies that can be performed concurrently with the implementation of the hydraulic control system. Microbiological assessment would include phospholipid-fatty acid (PLFA) and DNA analysis to determine levels of microbial biomass and community structure with specific screening for known dechlorinating organisms. Microcosm studies would include only very simple stimulation studies to verify that stimulation and/or nitrogen supplementation do, in fact, produce the desired changes in microbial activity under these geochemical conditions. Specific attention would also be paid to verifying, at least qualitatively, further dechlorination or degradation of cis-DCE to vinyl chloride to ethene. These combined efforts would be intended to provide confirmation of gross feasibility and some suggestion of initial design parameters for implementation of a phased remediation program.

Microbiological Assessment

Earth Tech proposes to take samples from six locations representative of the variety of conditions observed. The proposed locations are MWA002, MWA005, MWA006, PZ008I, PZ037I, and MW020S. PLFA analyses will be used to evaluate and compare the microbial community structures in the areas sampled to determine what range of microbiological conditions is occurring without enhancement. The same data will also be used during treatment to evaluate changes affected by any purposeful enhancement. DNA analyses will also be used to identify and enumerate organisms that are known or likely to be capable of reductive dechlorination both before and during treatment and used, in combination with the results from bench scale pilots, to optimize enhancement for those types of organisms.

Microcosm Treatability

Microcosm studies are proposed to satisfy some simple pre-design objectives while hydraulic control is being established at the site. The studies proposed will be simple and focused very specifically on the following issues.

1. Verify and quantify enhancement of the anaerobic biological system in the context of site-specific geochemistry.

2. Evaluate nutritional stress due to the apparent lack of nitrogen, verify that nitrogen supplementation is effective.
3. Verify the system's capacity to complete the dechlorination process.

Studies will be conducted either as static or limited-recirculation microcosms designed to simulate in-situ geochemistry by combining both solid and liquid media from the site. The specific configuration of the physical apparatus will depend upon the properties of the combined media but, in general, will consist of triplicate bioreactors for each condition tested. Each microcosm will be constructed and maintained identically throughout the study (estimated at 60 days), with the exception of the amendment scenario being tested. Measurements of pH and Oxidation Reduction Potential (ORP) would indicate the development of reducing conditions and the time for direct sampling for contaminants and microbiological characterization. At the completion of the study, comparisons of the extents of treatment and/or impacts on the microbial populations under different amendment scenarios would be used to develop baseline design values for in-situ treatment as well as control limits for process monitoring and, possibly a predictive model for treatment.

#73

Department of Water
(937) 333-3725
FAX 333-2833

City of Dayton, Ohio
320 W. Monument Avenue
Dayton, OH 45402

www.cityofdayton.org

Gary
Please let me know how we responded.

April 10, 2003

Mr. Gary Stanczuk
DaimlerChrysler Corporation
CIMS 482-00-51
800 Chrysler Drive
Auburn Hills, MI 48326-2757

Dear Mr. Stanczuk:

The City of Dayton, Department of Water appreciates your efforts to keep us informed of environmental activities at DaimlerChrysler – Behr. We feel your company has made an admirable effort to inform us as well as the public of your activities. We do, however, remain concerned that current and past offsite migration of ground water contaminants that flow towards our Great Miami Well Field Protection Area are not being adequately addressed in your proposed remediation efforts.

We thank you for the opportunity to review the Technical Memorandum, "Soil and Groundwater Remediation Summary – Dayton Thermal Products, Dayton Ohio". The City of Dayton has the following comments for your consideration.

As you know, our greatest concerns are related to offsite migration in the east-central portion of the property with the potential to affect our Well Field Protection Area. While the Technical Memorandum concludes that offsite migration will be prevented and extraction well pumping will be adequate to contain contamination (e.g. in the IW-1/EW-6 area), the following rationale enhances our concerns that gradient control may not be realized.

1. A less accurate measure of aquifer hydraulics via slug tests was performed rather than pump tests.
2. Injection rates were not taken into account. We are concerned that extraction rates of 100 gpm will be negated by equal injection rates. We are also concerned that mounding created by injection may mobilize contaminants outside of the EW-6 capture area. Even under extraction rates of 200 gpm, there is still cause for concern. We would like to see EW-6 be designed of sufficient size and pump capacity to extract ground water at much higher rates, if necessary.
3. From October 1999 through April 2001 ground water flow in the east central area was to the east and northeast. Our information indicates that once east of the CSX Railroad the ground water flow turns north and northeast across the Gem City Chemical property and on towards the Miami Well Field. We strongly recommend an additional monitoring well north of IW-1 to ensure that contaminants are not migrating to the north and northeast.

Mr. Gary Stanczuk
April 4, 2003
Page Two

The City of Dayton monitors numerous gradient control systems throughout the Well Field Protection area in buried valley deposits. The **successful** systems are pumping at rates of 450 to 900+ gpm, most of which are containing plumes that are smaller than the Dayton Thermal Products' plume. We request contingencies be built in to the proposed system to will allow greater extraction rates.

Additional concerns include current and past offsite migration emanating from the Dayton Thermal Products facility. It is our understanding that chlorinated compounds are moving on to the Gem City Chemical property from the southwest. While Gem City Chemical is providing gradient control near the southwest corner of Stanley and Air City Avenues, chlorinated compounds are migrating north across Stanley Avenue and are found at elevated levels in City monitoring wells, particularly MW71. Attached is a map and water quality data for three monitoring wells and a production well located at the southwest corner of the Miami Well Field. While impacts that have migrated this far are likely to be co-mingled, we are very concerned that contaminated ground water moving north across Stanley Avenue is <u>not</u> being addressed. We are asking that DaimlerChrysler look into this issue and mitigate future offsite migration both at the property line and that which has left the property.

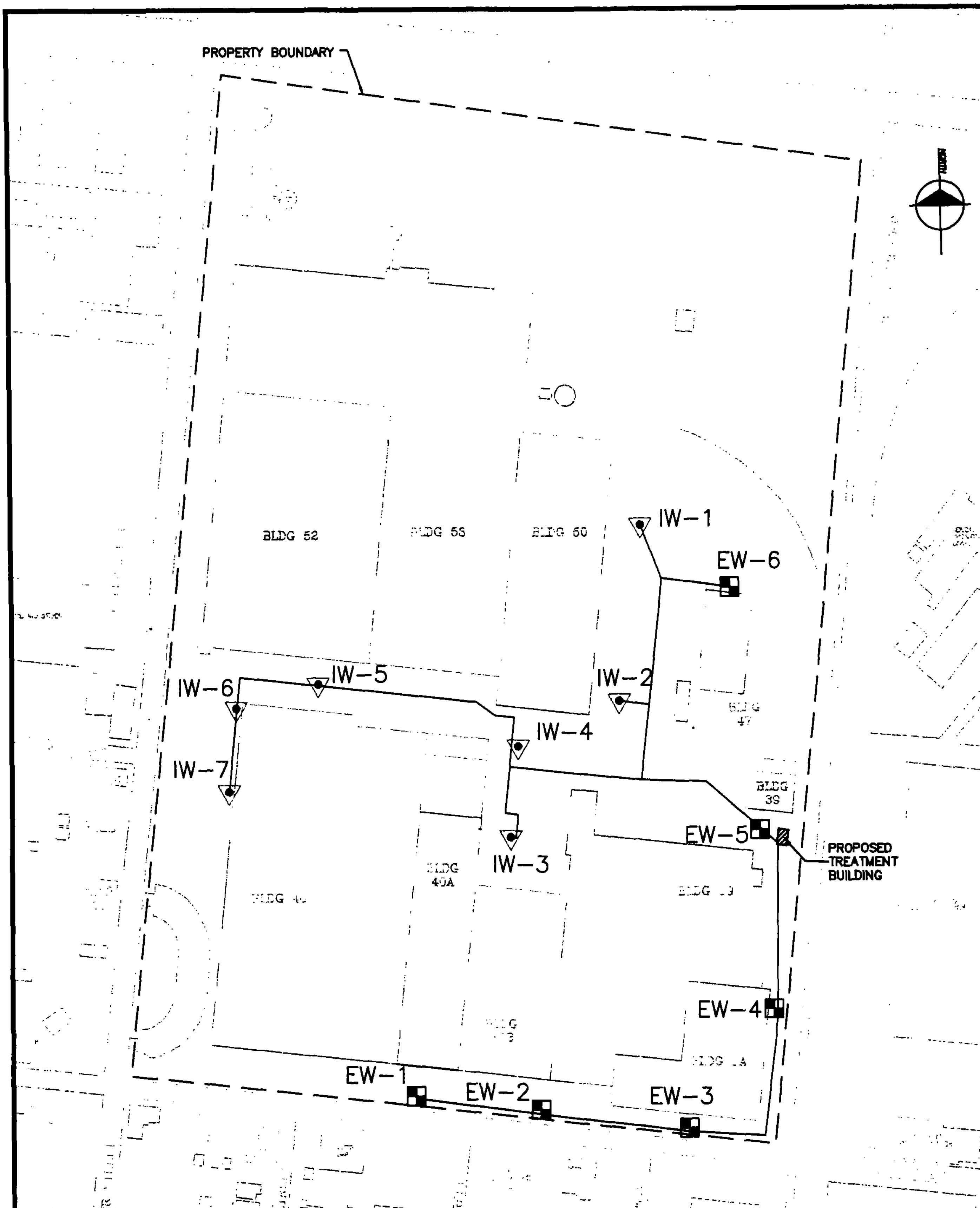
If you have any questions, please contact Jim Shoemaker or me at (937) 333-3725.

Sincerely,

Donna G. Winchester

Donna G. Winchester, Manager
Division of Environmental Management

c: J. Shoemaker, Hydrogeologist
J. Hines, OEPA-SWDO, Assistant District Chief
J. Smindak, OEPA-SWDO, DERR
M. Smith, OEPA-CO, DERR, VAP



LEGEND

- PROPOSED INJECTION WELLS
- PROPOSED EXTRACTION WELLS
- TRENCH AND PIPE

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY

FIGURE 8
WELL LOCATIONS
DAYTON THERMAL PRODUCTS SITE
DAYTON, OHIO

DRAWN BY: JRD	EDITED BY: JRD	PROJECT NUMBER: 55465	FILE NAME:
CHECKED BY: JE	DATE: MARCH 4, 2003	SCALE: 1:250	WELLS.DWG

INFORMATION SYNOPSIS - MIAMI MONITORING & PRODUCTION WELLS

MW69S

SCREEN: 50-60 (UNCONFINED); BORING DEPTH: 74

LOW PERMEABILITY DEPOSITS: 15-24

DATUM: 754.71, GROUND EL: 751.58, EASTING: 1497487.707, NORTHING: 655931.745

LOCATION: FAR W END OF GLOBE PROPERTY, ENTER RR ACCESS RD. @ LEO ST., HEAD N. & ENTER @ GATE

RECEPTORS: S CENTRAL & SW PWs

FLOW DIRECTION: VARIABLE TO THE NORTH

DATE	PCE	TCE	1,1 DCE	1,2 DCE	1,1,1 TCA	1,1 DCA	TOL	EBEN	XY			
9/26/97		29.8		2.5								
2/16/00		4.9										
4/25/00		14.5		3.0								
9/5/01		26.0		4.2								
2/12/02		24.1		3.8								
5/30/02		28.5		4.4								

MW70S (FM)

SCREEN: 59-69 (UNCONFINED); BORING DEPTH: 72

LOW PERMEABILITY DEPOSITS: 15-16, 21-21.5, 33-34.5 & 69-72+

DATUM: 747.84, GROUND EL: 748.60, EASTING: 1497758.371, NORTHING: 655679.896

LOCATION: CENTER OF GLOBE PROPERTY, ENTER RR ACCESS RD. @ LEO ST., HEAD N. & ENTER @ GATE

RECEPTORS: S CENTRAL & SW PWs

FLOW DIRECTION: VARIABLE TO THE NORTH

DATE	PCE	TCE	1,1 DCE	1,2 DCE	1,1,1 TCA	1,1 DCA	TOL	EBEN	XY			
9/18/97		5.6		2.1								
2/16/00		2.2		1.2								
4/25/00		1.5		1.2								
9/6/01		1.3		1.2			16.5					
2/12/02		1.4		1.1			16.6					
5/30/02		1.3		1.1			30.0					

MW71S (FM)

SCREEN: 52.9-62.6 (UNCONFINED); BORING DEPTH: 70.5

LOW PERMEABILITY DEPOSITS: 65.5-70.5+

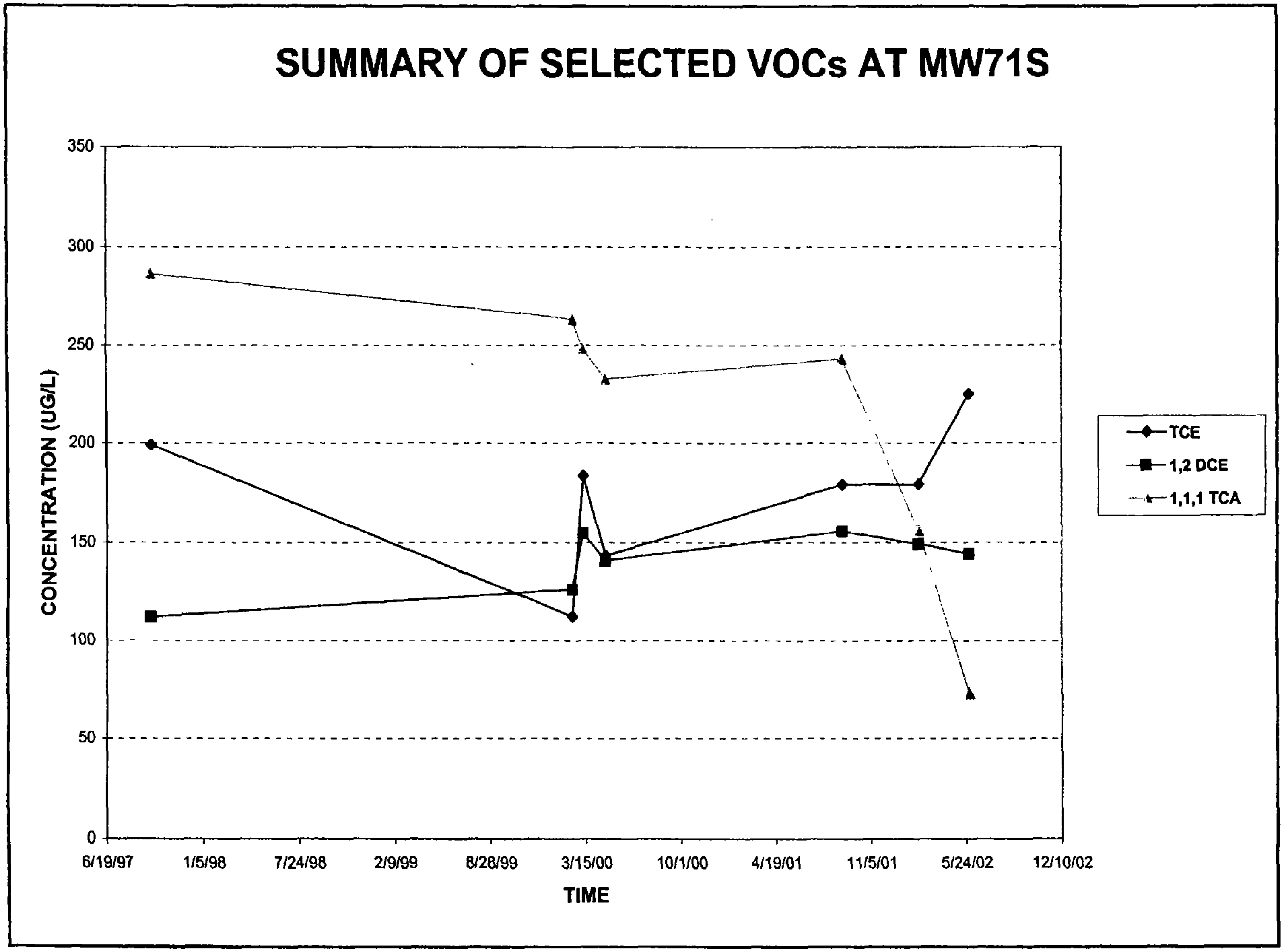
DATUM: 742.79, GROUND EL: 743.27, EASTING: 1498226.469, NORTHING: 655586.696

LOCATION: SE CORNER OF PROPERTY, ENTER RR ACCESS RD. @ LEO ST., HEAD N. & ENTER @ GATE

RECEPTORS: S CENTRAL & SW PWs

FLOW DIRECTION: VARIABLE TO THE NORTH

DATE	PCE	TCE	1,1 DCE	1,2 DCE	1,1,1 TCA	1,1 DCA	1,2 DCA	BEN	CF	1,1,2 TCA	CT
9/18/97		199.0		111.9	286.0	19.0	0.8	0.6	1.4		
2/16/00		112.0	23.6	125.9	263.0	18.5	0.8	0.9	1.5		
3/9/00		183.4	22.5	154.7	248.0	18.1		0.7	1.4	0.4	
4/25/00		143.1	19.8	140.8	232.6	17.1	0.6	0.7	1.2		
9/5/01		179.0	27.6	155.6	242.8	21.0	0.9	0.9	1.7	0.5	
2/12/02		179.1	21.6	149.1	155.8	17.3	0.6	0.8	1.3	0.4	38.6
5/30/02		224.9	25.4	144.2	72.8	20.5	0.9	0.9		0.4	41.2

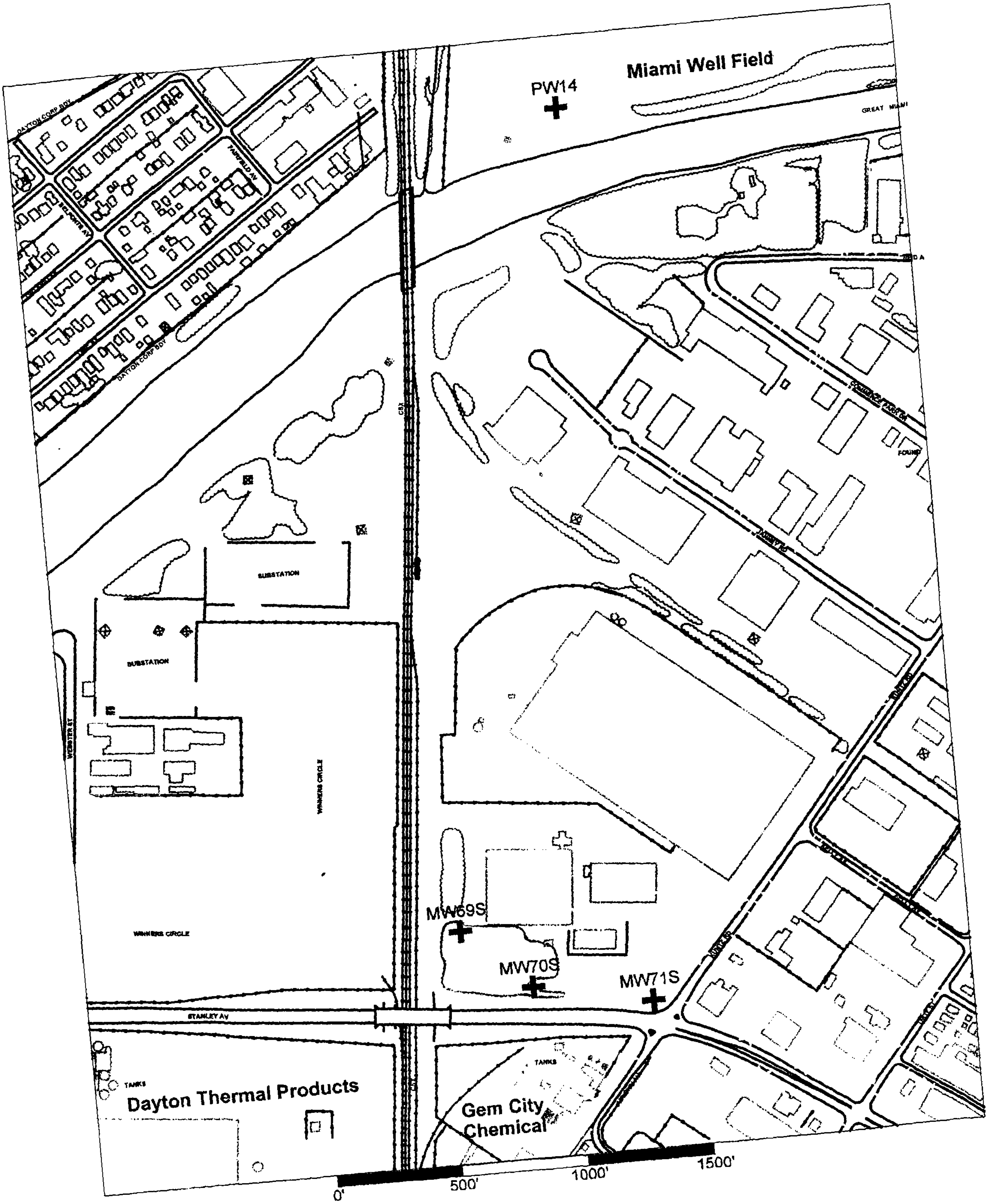

SUMMARY OF SELECTED VOCs AT MW71S
CONCENTRATION (UG/L)
350
300
250
200
150
100
50
0
6/19/97
1/5/98
7/24/98
2/9/99
8/28/99
3/15/00
10/1/00
4/19/01
11/5/01
5/24/02
12/10/02
TIME
TCE
1,2 DCE
1,1,1 TCA

PRODUCTION WELL PW14R
SCREEN: 80-120 (CONFINED)
LOW PERMEABILITY DEPOSITS: 0-71, 119-135+
DATUM: 755.22, EASTING: 1498155.4, NORTHING: 659208.07
STATUS: INACTIVE, PENDING CONNECTION TO AIR STRIPPER

DATE	TCE	1,2 DCE	PCE	1,1 DCA	CF	NAPH	1,1,1TCA	XY				
2/9/87												
5/27/87												
4/4/88		0.6										
7/12/88				13.3								
10/18/88												
1/17/89												
4/10/89												
7/6/89	1.0											
10/20/89		0.3		5.9								
1/2/90	1.1	0.5										
4/9/90	1.8	0.3										
7/2/90	2.2	0.3										
10/1/90	2.1	0.4										
1/8/91	0.6											
4/1/91	3.4											
7/1/91	3.0											
10/1/91	3.5											
1/9/92	2.9	0.5										
4/1/92	2.9	0.5										
7/7/92	3.5	0.5										
10/6/92	4.0	0.5										
1/28/93	1.9											
4/20/93	2.6					3.2						
7/13/93	3.3											
11/12/93	2.2											
1/10/94	3.0											
9/27/95	2.7											
12/18/95	3.7											
3/26/96	3.5											
3/17/97	4.3	0.8										

PW14R - PAGE TWO

DATE	TCE	1,2 DCE	PCE	1,1 DCA	CF	NAPH	1,1,1TCA	XY				
6/23/97	4.7	0.8										
10/2/97	5.4	0.6										
11/25/97	5.9	0.5										
12/5/97	4.9	0.4										
12/12/97	5.0	0.5										
12/23/97	5.7	0.6										
12/30/97	4.7	0.6										
1/9/98	5.4	0.6										
1/16/98	6.0	0.7										
2/6/98	4.6	0.6										
2/20/98	4.3	0.5										
2/27/98	4.8	0.6										
3/13/98	3.7	0.5										
3/20/98	4.6	0.5										
4/6/98	4.1	0.4										
9/1/99	3.5	0.7										
11/17/99	4.8	0.8										
6/6/00	3.7	0.5										
5/1/01	0.7											
10/29/01	2.9	0.8										
1/6/03	2.4	0.7										


Miami Well Field
PW14
GREAT MIAMI
SUBSTATION
SUBSTATION
WINNERS CIRCLE
WINNERS CIRCLE
WEBSTER ST
MW69S
MW70S
MW71S
STANLEY AV
TANKS
TANKS
Dayton Thermal Products
Gem City Chemical
0'
500'
1000'
1500'

#74

August 11, 2003

DaimlerChrysler Corporation

Mr. John Spitler
Environmental Specialist
Division of Surface Water
Southwest District Office
401 East Fifth Street
Dayton, OH 45402-2911

Re: Completion of Pump Test on Extraction Well No. 6 and Supporting Data

Dear Mr. Spitler:

This is to inform you of the discharge data collected by Earth Tech before and during pump testing of Extraction Well No. 6 as part of the SVE/Groundwater Remediation Project at BEHR Dayton Thermal Products being completed by DaimlerChrysler under the VAP.

The details of the completed pump test are as follows:

1. The test lasted approximately 27 hours.

2. Pump rate was 90 gpm.

3. Water pumped was passed through an Air Stripper rated for 300 gpm flow, to remove groundwater contaminants identified in the project.

4. Water discharged from the Air Stripper was discharged to the Storm Sewer Outfall 002 covered by the Sites NPDES Permit. The water quality was tested for volatile organic compounds (VOCs) by method 8260 prior to the start of the discharge from the inlet to the air stripper (AS-IN) and the effluent of the air stripper (AS-OUT) on July 16, 2003 with the discharge contained in a on site tank. The results are attached and the discharge results were below detection as expected.

5. Extraction Well No. 6 is located just north of the powerhouse at BDTP.

6. Upon receiving the results from the testing on July 16, 2003, the pump test was commenced on July 22, 2003 at 10:10 A.M. The discharge was observed intermittently during the test and found to consist of clear water with no visual sheen or discoloration. Samples were collected during the middle of the test on July 22, 2003 at 16:40 (AS-

DaimlerChrysler Corporation
800 Chrysler Drive CIMS 482-00-51
Auburn Hills MI USA 48326-2757

PT01) and near the end of the test at July 23, 2003 at 09:10 (AS-PT03). Both were analyzed for VOCs by method 8260 with no detections. The results are attached. The test was completed on July 23, 2003 at 13:00. The total discharge from the test was 145,000 gallons. In addition, the contents from the onsite tank used for development and preliminary testing of water from the extraction well was discharged at about 40 gpm through the air stripper to Outfall 2 for an additional volume of approximately 9,000 gallons.

If you should have any additional questions, please let me know.

In addition, could you please let us know the status and anticipated approval date for the NPDES permit modification for the site submitted on January 21, 2003? We need to schedule the construction and start-up for the groundwater remediation system for the site. Please contact me at 248-576-7365 or Rob Stenson of Earth Tech at 920-451-2407. Thank you for your help.

Sincerely,

Gary M. Stanczuk
Remediation Specialist
Assessment, Deactivation & Remediation

c. Bill Houston – Behr
Rob Stenson – Earth Tech
James R. Dickson – Earth Tech

#75

TECHNICAL MEMORANDUM

North and South Soil Vapor Extraction System 2nd Quarter 2004 Status Report -

Dayton Thermal Products Plant, Dayton, Ohio

PREPARED FOR:	Gary Stanczuk – DaimlerChrysler Corporation
PREPARED BY:	Jamie Dickson – Earth Tech
COPIES:	Rob Stenson – Earth Tech
DATE:	July 15, 2004

DAIMLERCHRYSLER DOCUMENT CONTROL NO.
SC001.1029.2004.001

Introduction

Upon Completion of the 1st quarter 2004 sampling event both systems operated until the 2nd quarter sampling event as discussed in the monthly reports for April 2004 and May 2004.

Soil Vapor Extraction System Strategy

The strategy for SVE remediation of the contaminant source area is to provide coverage of the source area with extraction/injection well points. The system is designed as two independent units. The North System provides coverage for Buildings 50, 53, part of 59 and the truck-way between the buildings. The South System provides coverage for Buildings 40, 40A 40B, and the remaining portion of Building 59. The as-built layout of SVE wells, piping, and equipment buildings are shown on Figure 1.

Each unit consists of a regenerative blower system capable of generating 1,000 SCFM at 8-inches of mercury, extraction and injection manifold piping, and independently-operated banks of up to 12 well points activated by pneumatic valves set by timers. The SVE system design included banks of well points, cycled by timers, to maintain the required design vacuum pressure rate for establishing the radius of influence at each well point. The banks are connected to both the extraction and the injection manifolds to provide flexibility to use a well point bank as an extraction or injection system. The combined ability to both extract and inject air provides the flexibility to focus the flow of air as needed during remediation.

During the initial system start-up, the distribution and concentration of contaminants in the source area was mapped based on the analytical laboratory results and the radius of influence of each well point. Mapping the distribution and concentration of contaminants allowed the system to be operated as a conventional SVE system in areas of widespread contamination, and to be focused using a combination of extraction and injection well points in hot spot areas and void zones present as a result of access limitations in the plant. As areas are remediated to acceptable concentrations, individual well points will be shut down to increase the vacuum and airflow in other well points in the bank or combination of banks. The net effect of shutting down well points and focusing extraction/injection as the remediation progresses is to increase the strength of the system for the remediation of the highest concentration areas. During the first Quarterly sampling event all wells were placed back online to verify that all contaminants have been removed from the areas that were initially clean. Detection of contaminants in areas that were initially clean could be a result of the water table elevation dropping to expose soil that was previously masked or from pulling air from a previously unidentified source area into the pore space that was initially clean.

SVE System Components

Operational Summary

The North and South SVE systems were operated from April 1, 2004 when the last quarterly sampling event occurred until the end of June 2004. Both the North and Soiuth systems operated with all banks on-line in the original configuration for the month of April 2004. Prior to the May 2004 sampling event, both the North and South systems banks were combined to optimize recovery of volatile organic compounds (VOCs). The North system had problems with water collection in the cross-connect pipe between the buildings and ran intermittently. The south system ran trouble free. For the Quarterly sampling event at the end of June, all wells were placed in service and run in the original bank configuration.

North System Start-Up

The North System began operations on April 2004 running all well on all banks. (See operational Summary Table 1). After one month of operation (May 5, 2004), the system was set to run combined Banks 3, 5 and 6 (wells 3-8, 5-2, 5-3, 5-7, 6-2, 6-3, 6-11 and 6-13) and Bank 4 (wells 4-1, 4-4, 4-5, 4-5, 4-6, 4-8, 4-10 and 4-12) to focus the extraction to the wells with the highest concentrations. During this operation increased water production shut down the system several times. The operation was altered to run Bank 1 and Bank 2 between the combined Banks 3, 5 and 6 and optimized Bank 4 in order to provide full flow through the cross-connect line to clear out any accumulated water. This proved to be unsuccessful and resulted in system shutdown. Even with the system shut off water continued to accumulate in the cross-connect pipe after several pump outs. This combined with the amount of rain lead to the conclusion that there was a leak in the below ground pipe letting surface/subsurface water in the pipe. The same problem was not experienced in the re-injection manifold so the system was re-piped to run on the re-injection manifold for extraction purposes.

For the quarterly testing, all the north banks were placed on-line and samples were taken from all accessible wells.

The operational summary of the North SVE System operations is provided in Table 1. The extracted volatile organic compounds (VOCs) data summary for the North SVE System is provided in Table 2 and the laboratory data summary collected from both systems is provided in Table 4.

South System Start-Up

The South System began operations on April 2004 running all well on all banks. (See operational Summary Table 1). After one month of operation (May 5, 2004), the system was set to run combined Banks as follows to focus the extraction to the wells with the highest concentrations:

- Banks C, E & F (Wells C-3, C-5, C-8, E-1, F-1, F-8, F-10 and F-11); and
- Banks G, H & I (Wells G-1, G-6, G-9, H-12, I-1, I-5, I-6, I-7 and I-10).

The operational summary of the South SVE System operations is provided in Table 1. The extracted VOCs data summary for the South SVE System is provided in Table 3 and the laboratory data summary collected from both systems is provided in Table 4.

Vapor Concentration at Well Points

The data collected at each well point was analyzed to evaluate the contaminant distribution within the treatment zone. This data was compiled for total VOCs, PCE, TCE, cis-1,2-DCE, vinyl chloride, 1,1,1-TCA, and 1,1-DCE and is presented in the figure set along with the Start-up Figures to show clean-up progression. The figures present a color-coded scale that relates to interpolated well concentrations in parts per million by volume (ppmv). This figure set will continue be modified during the operational history of the SVE system by the addition of new figures for each quarterly well point sampling event. The decrease in VOC concentrations over time will document remediation of the treatment zone.

Mass Removed

Table 5 presents the total VOCs and hazardous air pollutants (HAP) removed in the 2nd Quarter 2004. Table 6 provides the total mass removed in 2003, 1st Quarter 2004, 2nd quarter 2004 and projected mass for the remainder of 2004 based on the anticipated combinations of banks and wells

The cumulative total VOCs removed from the soil over time per system and combined is presented on Chart 1.

Proposed System Operations

Below is the proposed operational configuration adjustments to be made prior to next month's sampling event. (All banks will be run in the original configuration until that time.)

North System

Continue to operate on all banks at equal time settings. This configuration will produce up to 4.6 lbs/month.

South System

Continue to operate on all banks at equal time settings. This configuration will produce up to 2.8 lbs/month.

Combined System Production

The total combined production will be up to 7.4 lbs/month.

Figures

NOTE: WELL LABLES CONSIST OF BANK – WELL NO. THE NORTH SYSTEM HAS BANKS 1–6 AND THE SOUTH SYSTEM HAS BANKS A–H.

EARTH TECH

A tyco INTERNATIONAL LTD. COMPANY

4135 Technology Parkway, Sheboygan, WI 53083 (920) 458-8711

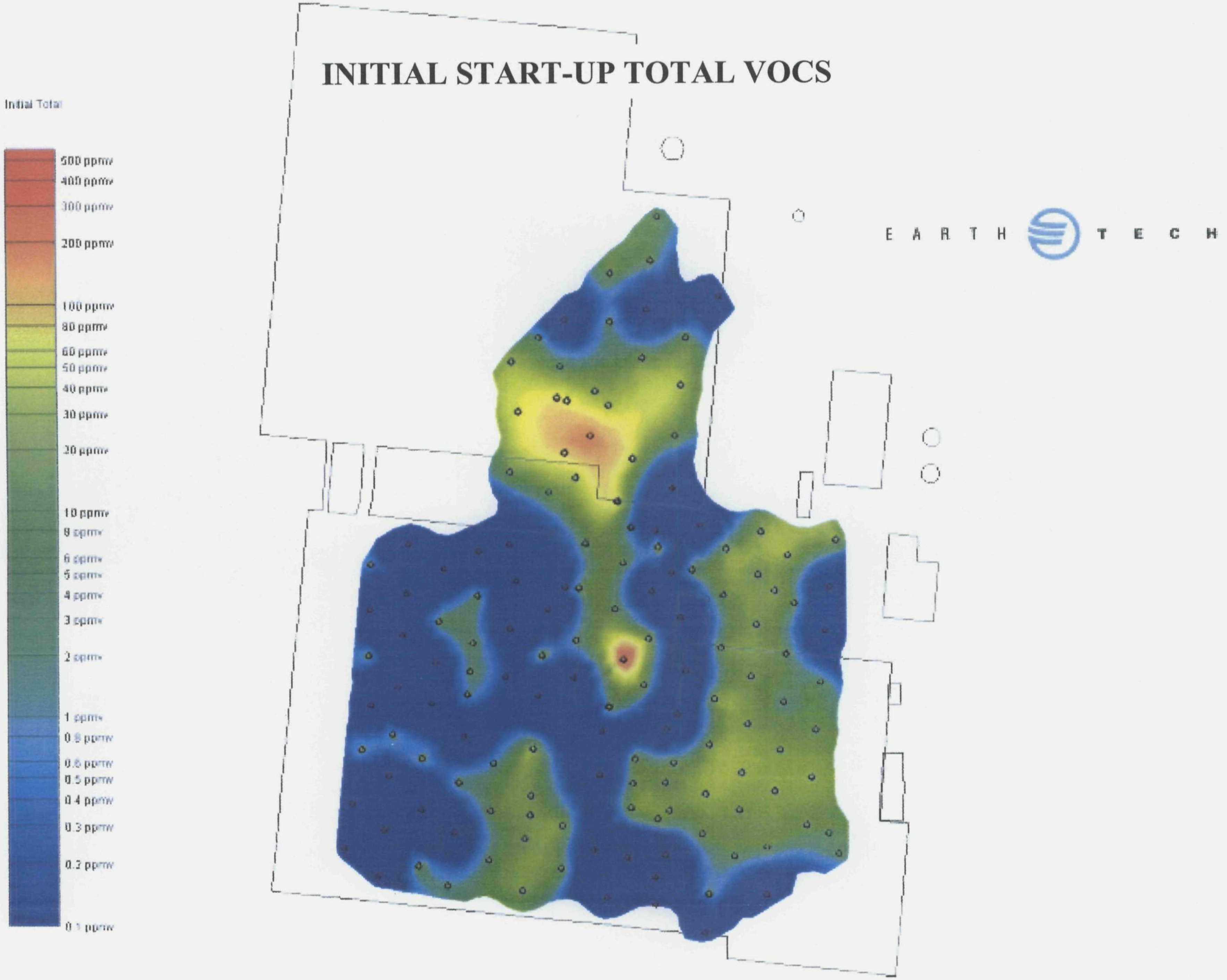
DRAWN BY: JRD	DATE: OCT. 29, 2003
CHECKED BY: SC	EDITED BY: JRD
FILE NAME: START UP.dwg	

FIGURE 1
SVE Layout

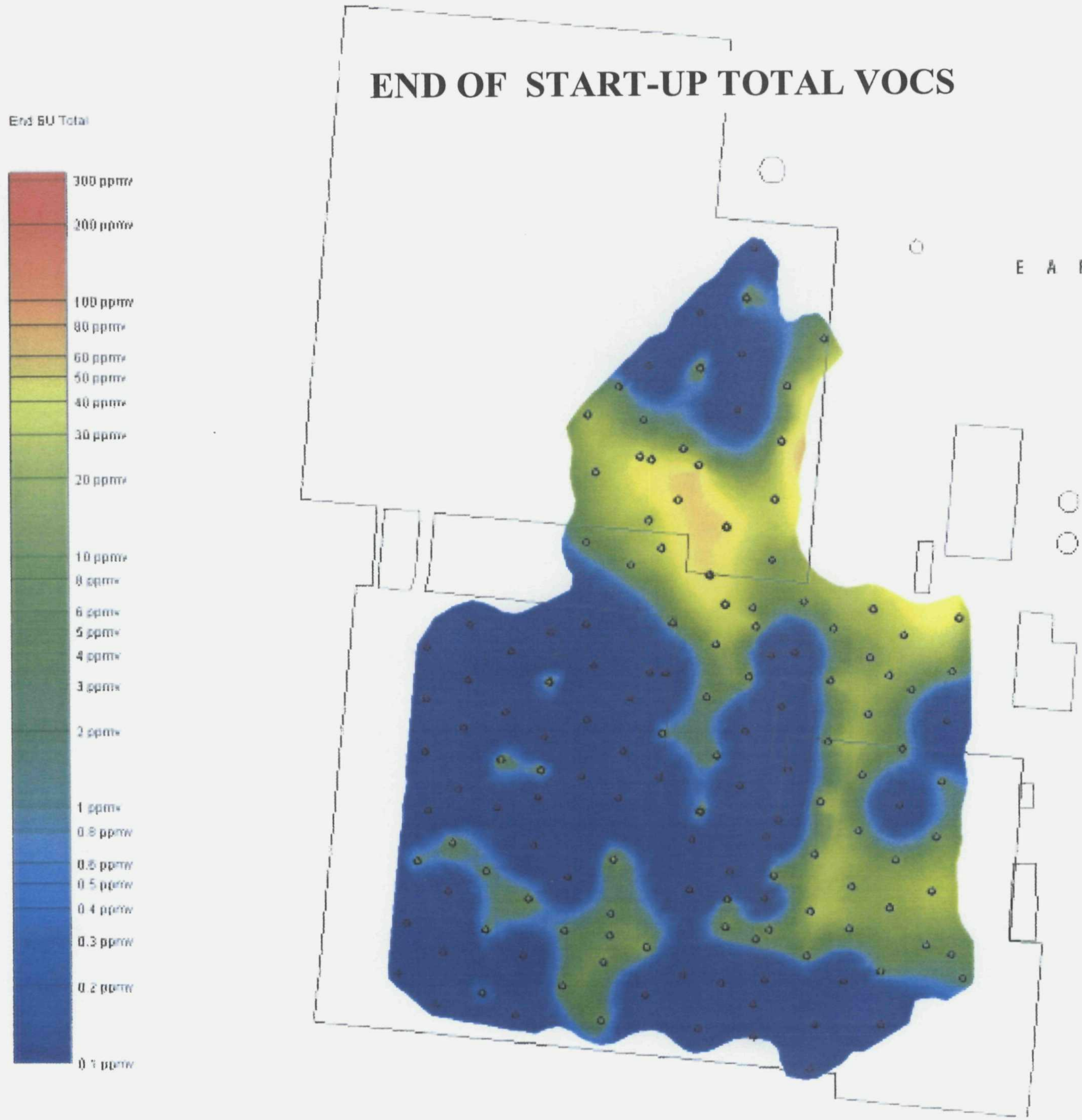
DAYTON THERMAL PRODUCTS SITE
DAYTON, OHIO

PROJECT NUMBER 63393

INITIAL START-UP TOTAL VOCS

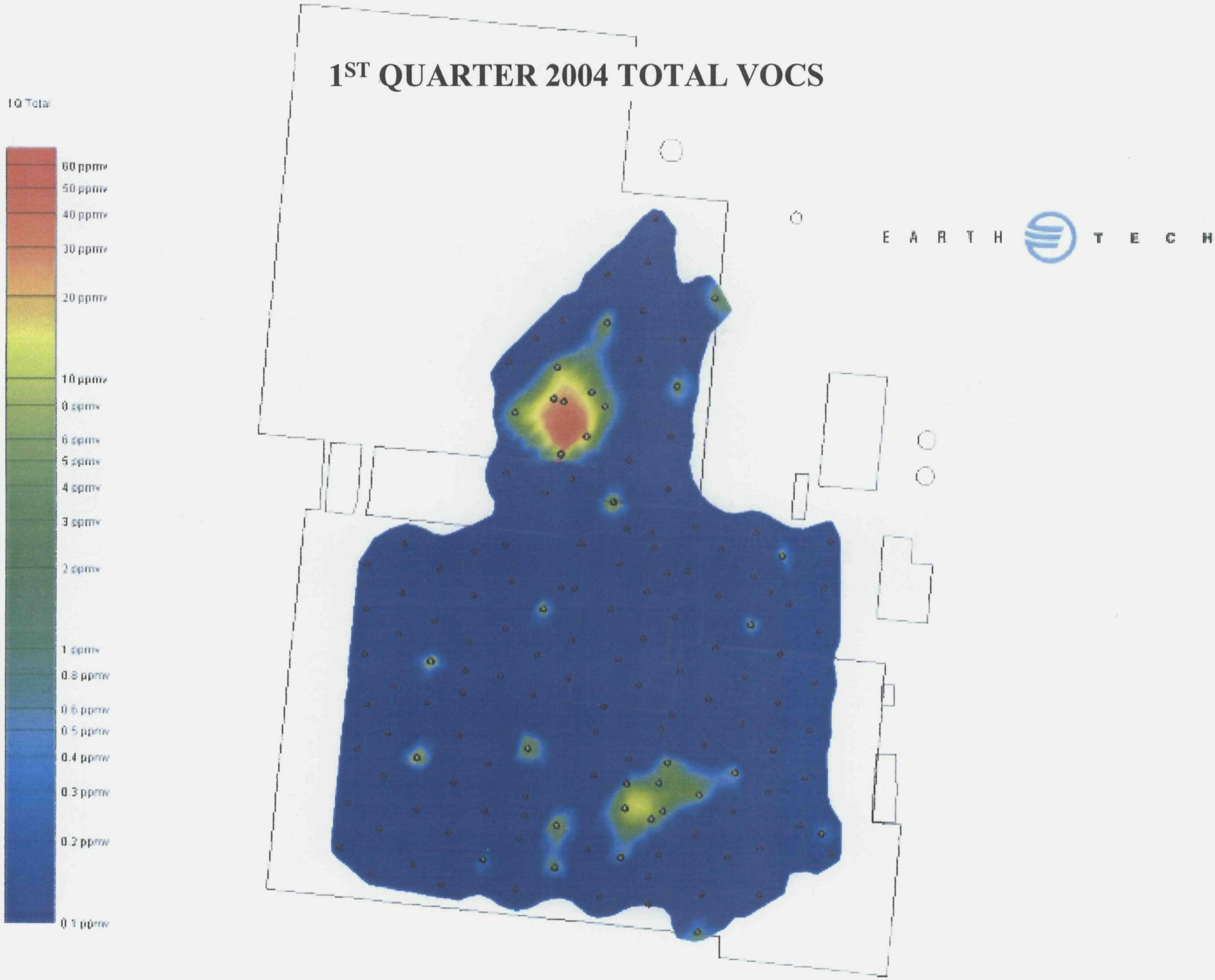


END OF START-UP TOTAL VOCS

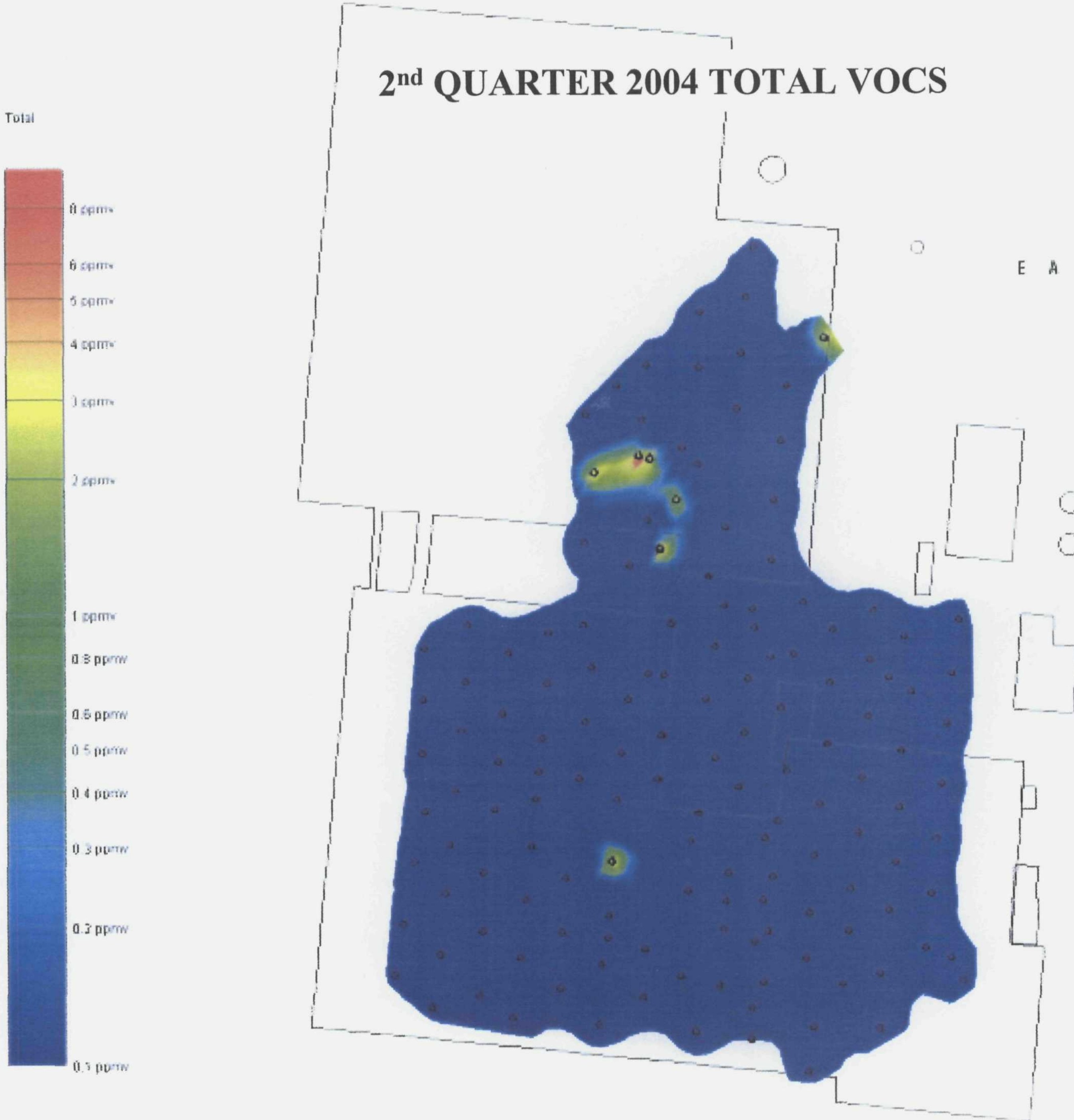


EARTH TECH

1ST QUARTER 2004 TOTAL VOCS

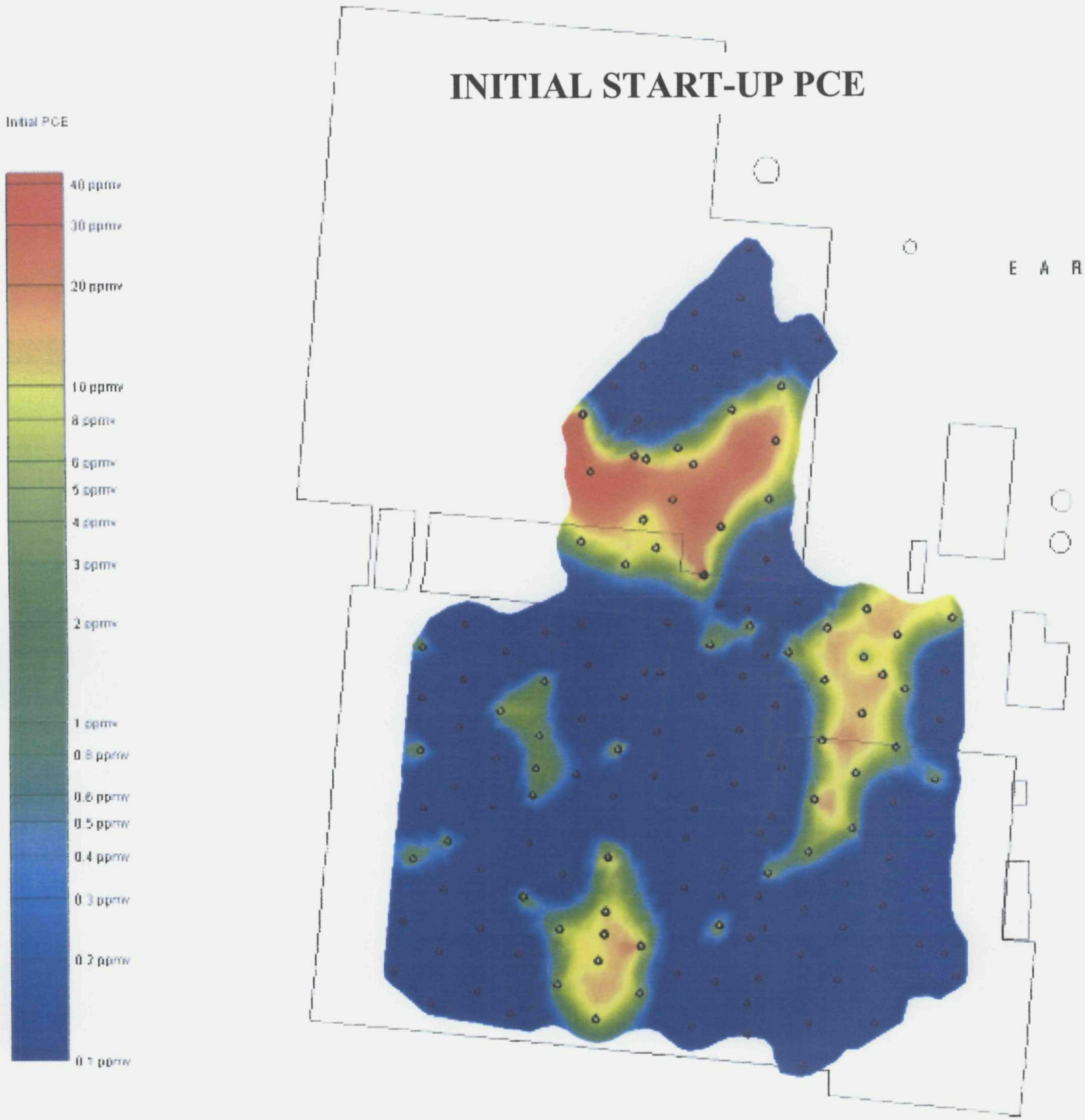


2nd QUARTER 2004 TOTAL VOCS



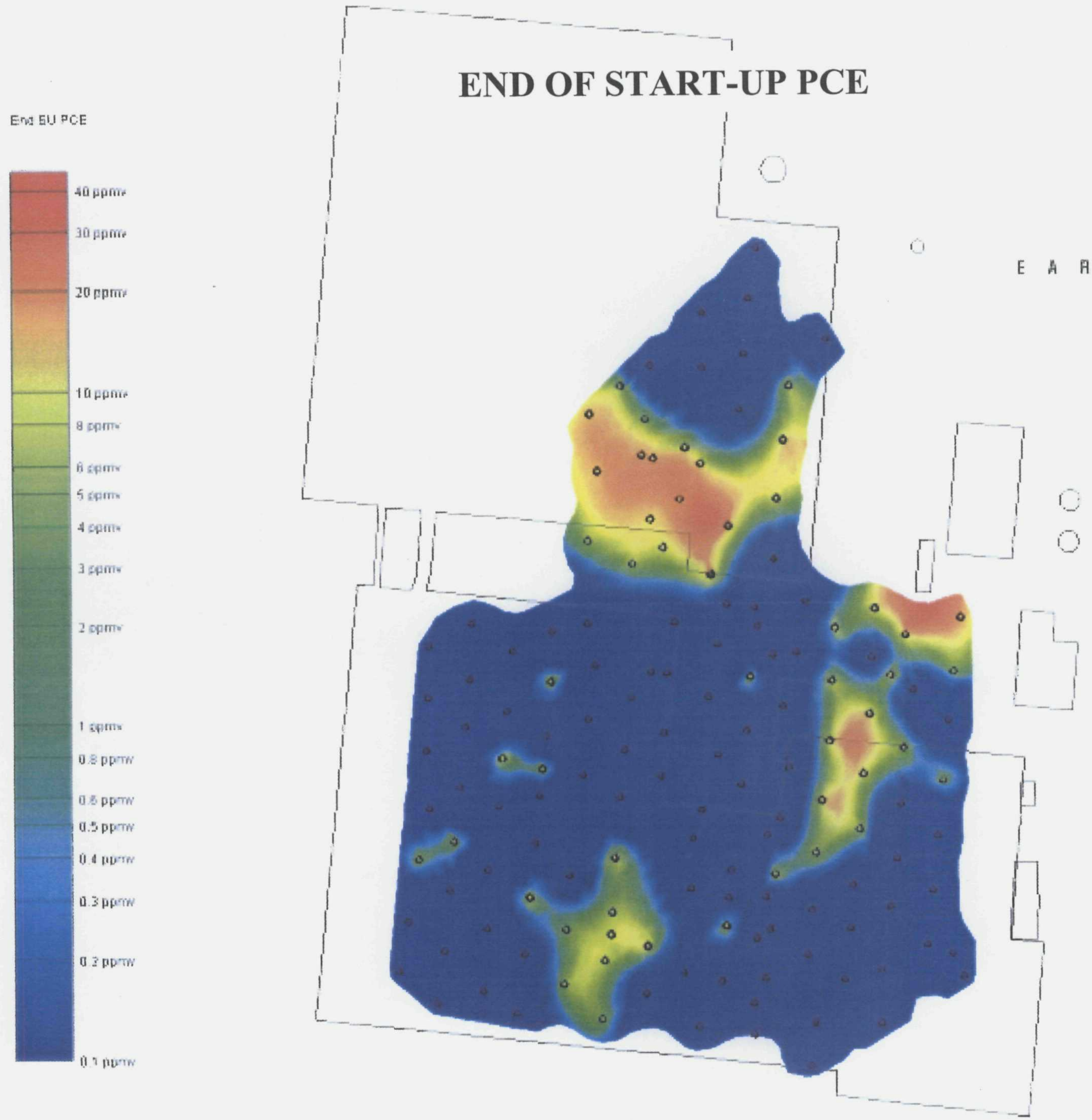
EARTH TECH

INITIAL START-UP PCE



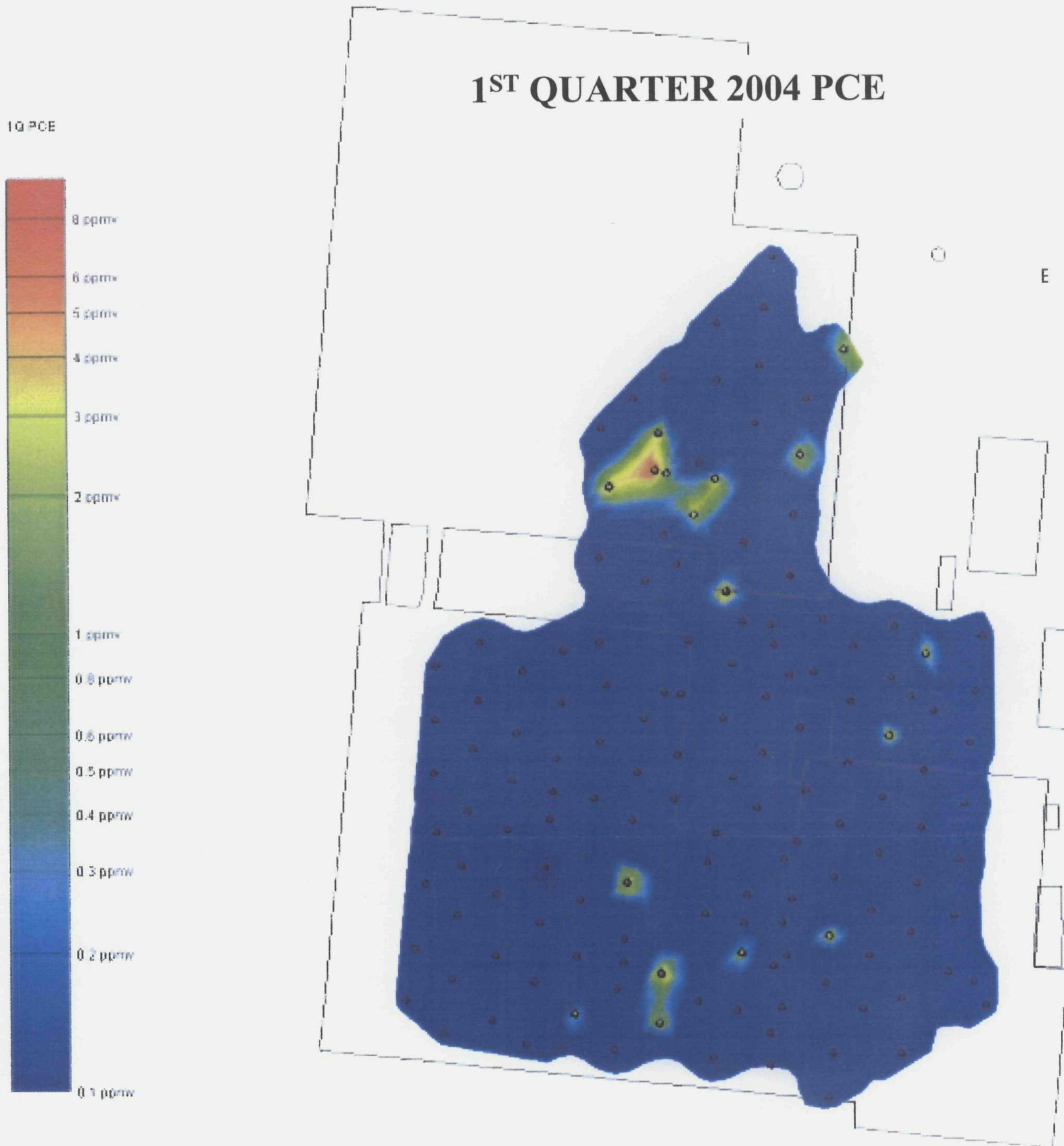
EARTH TECH

END OF START-UP PCE



EARTH TECH

1ST QUARTER 2004 PCE



EARTH TECH

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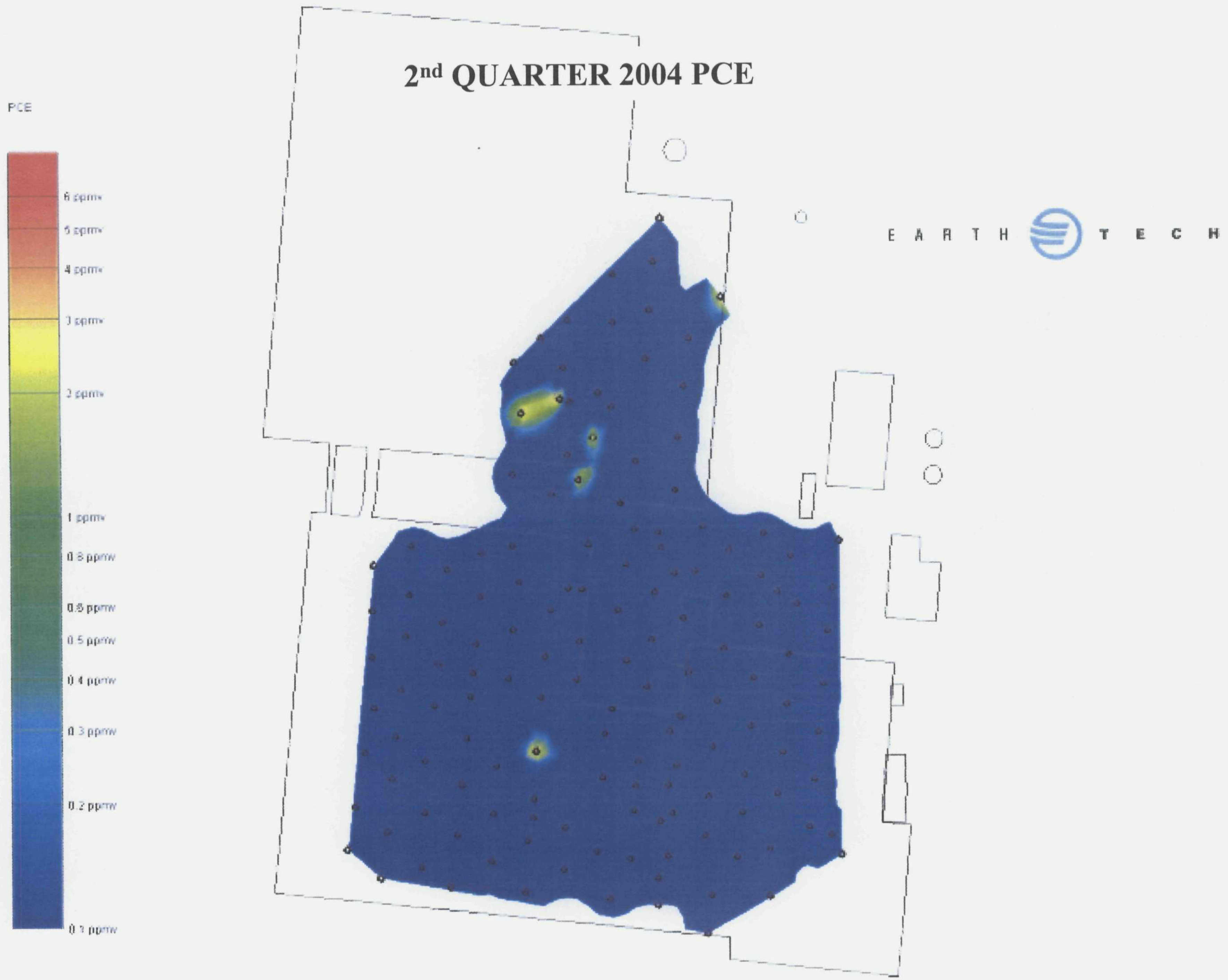
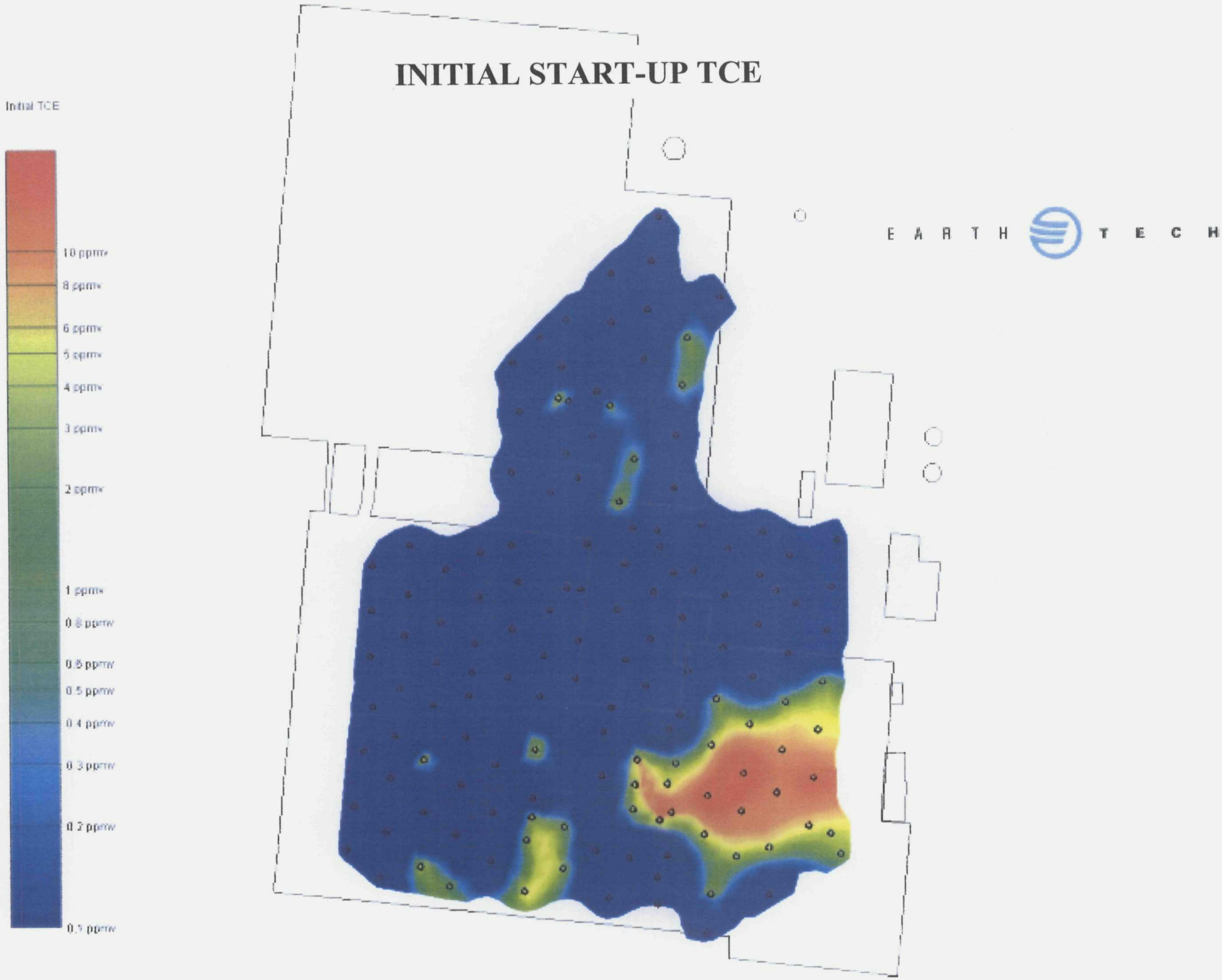


INITIAL START-UP TCE



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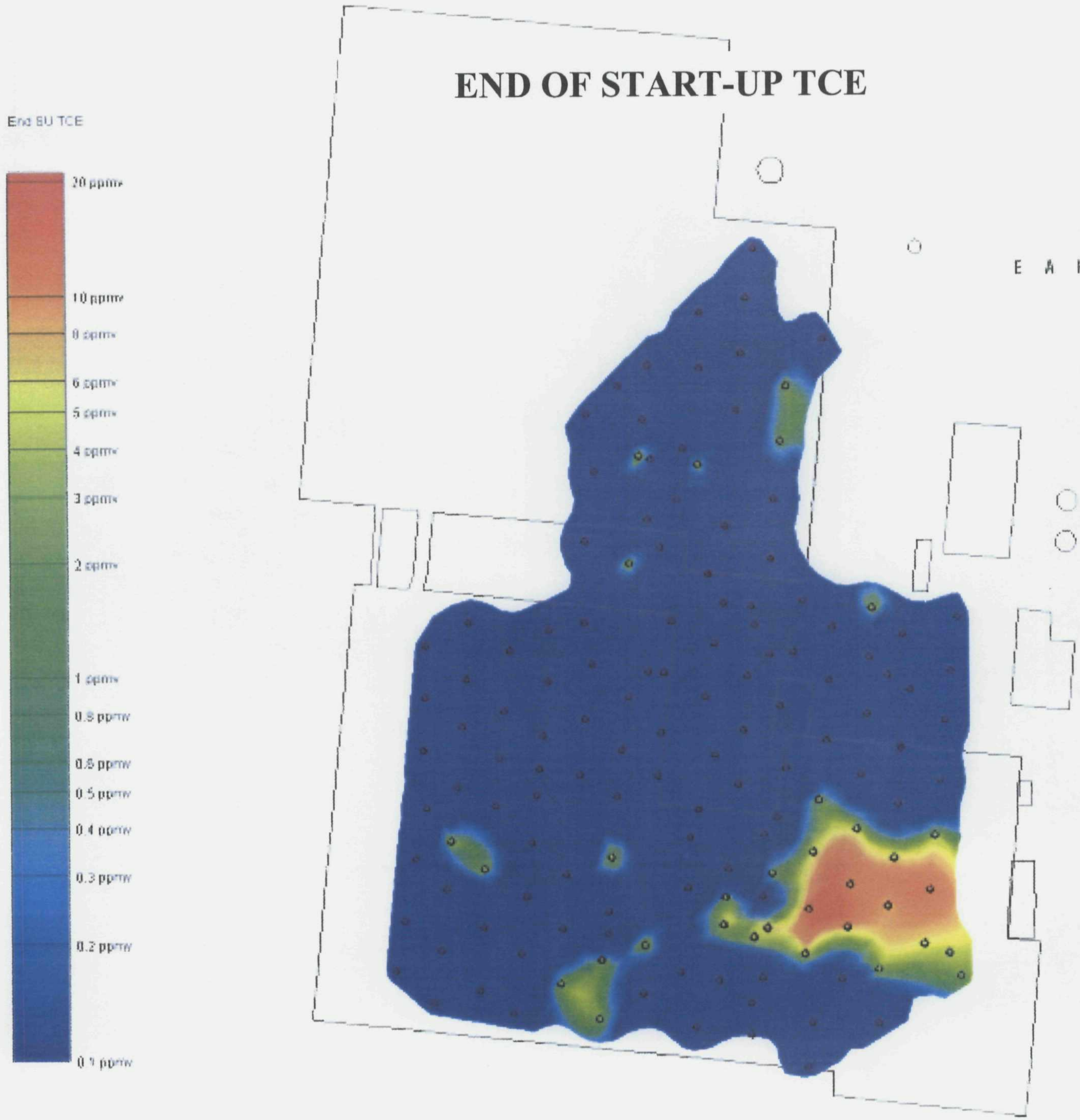
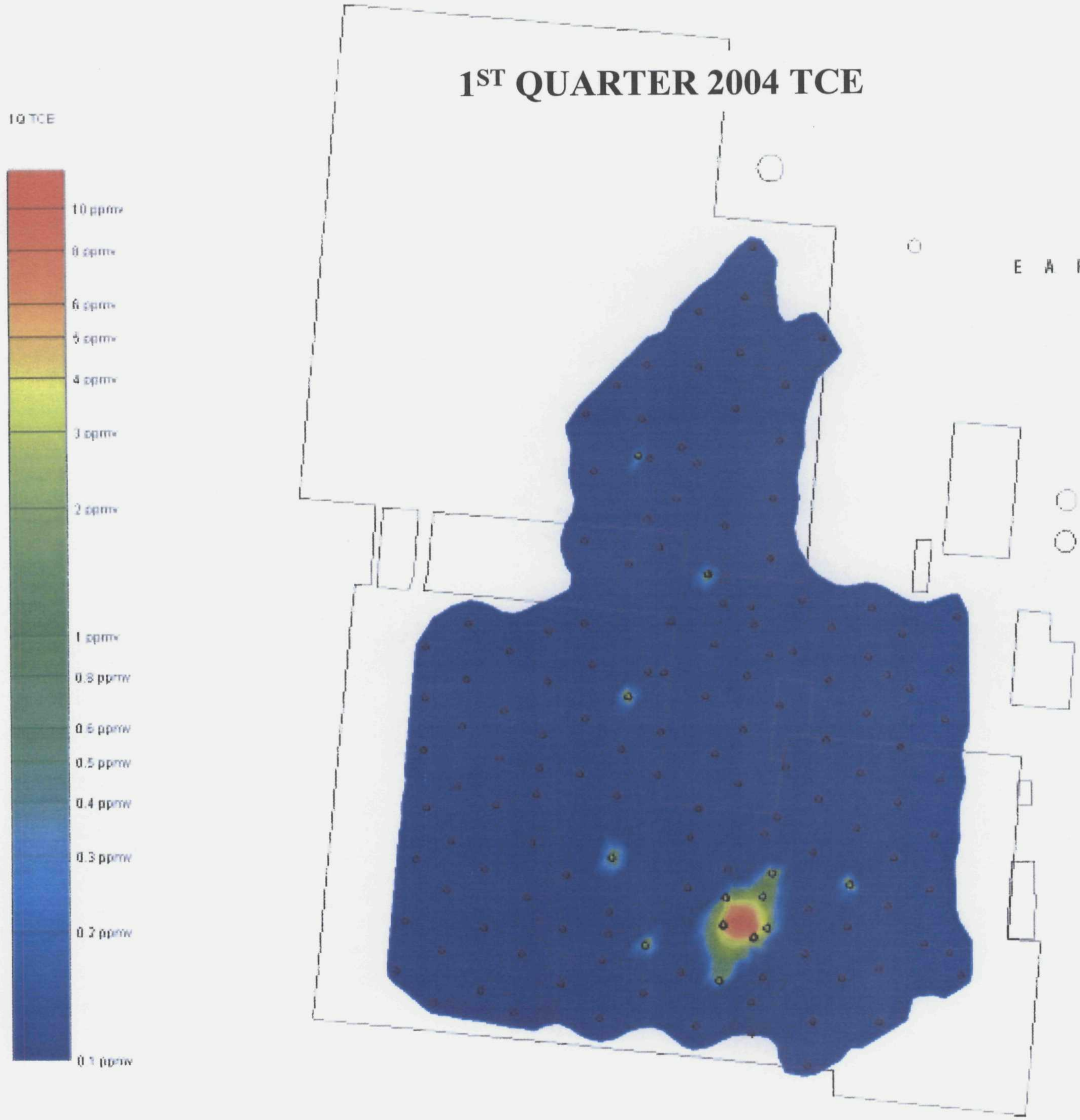


EARTH TECH

1ST QUARTER 2004 TCE



EARTH TECH

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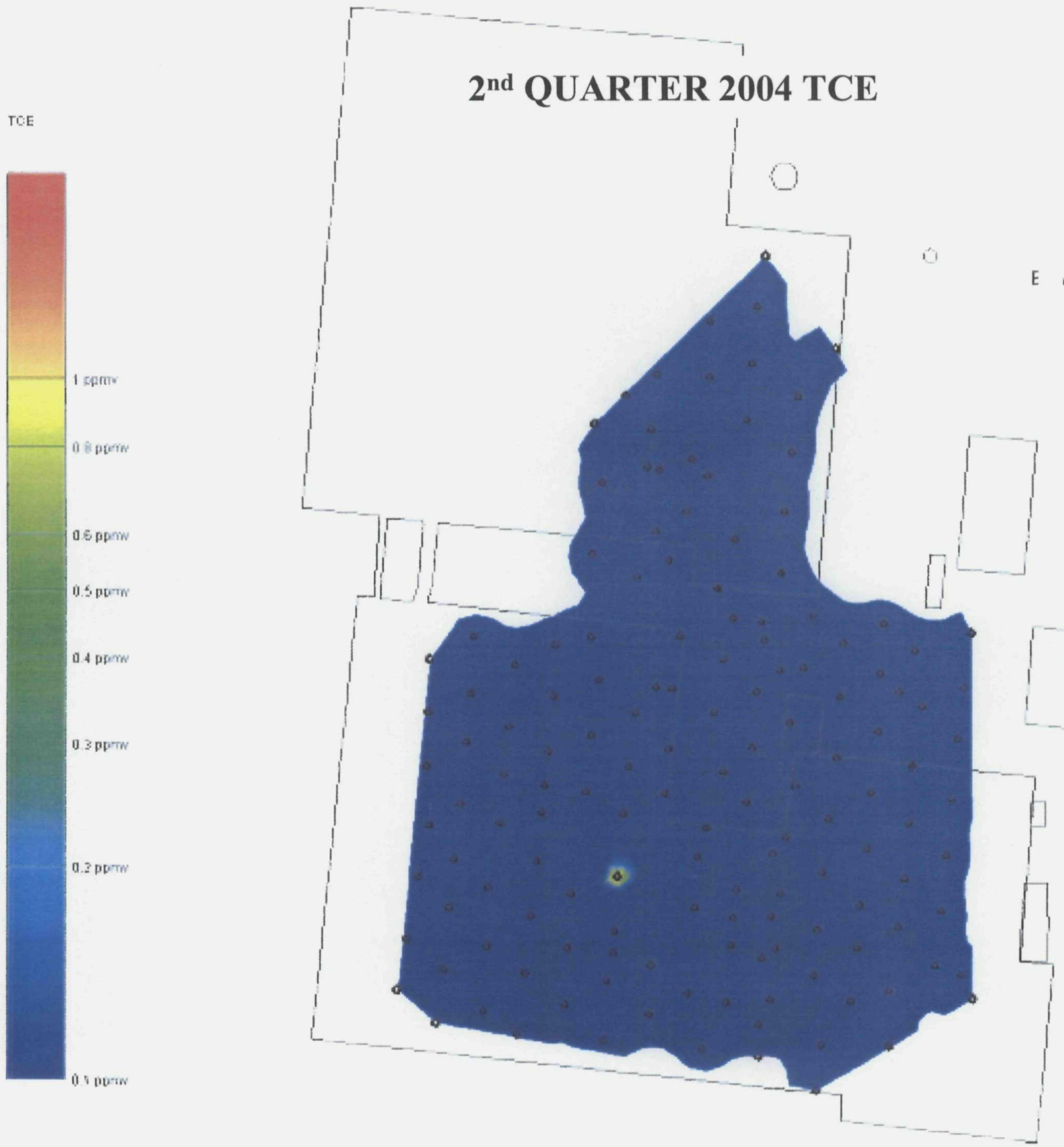
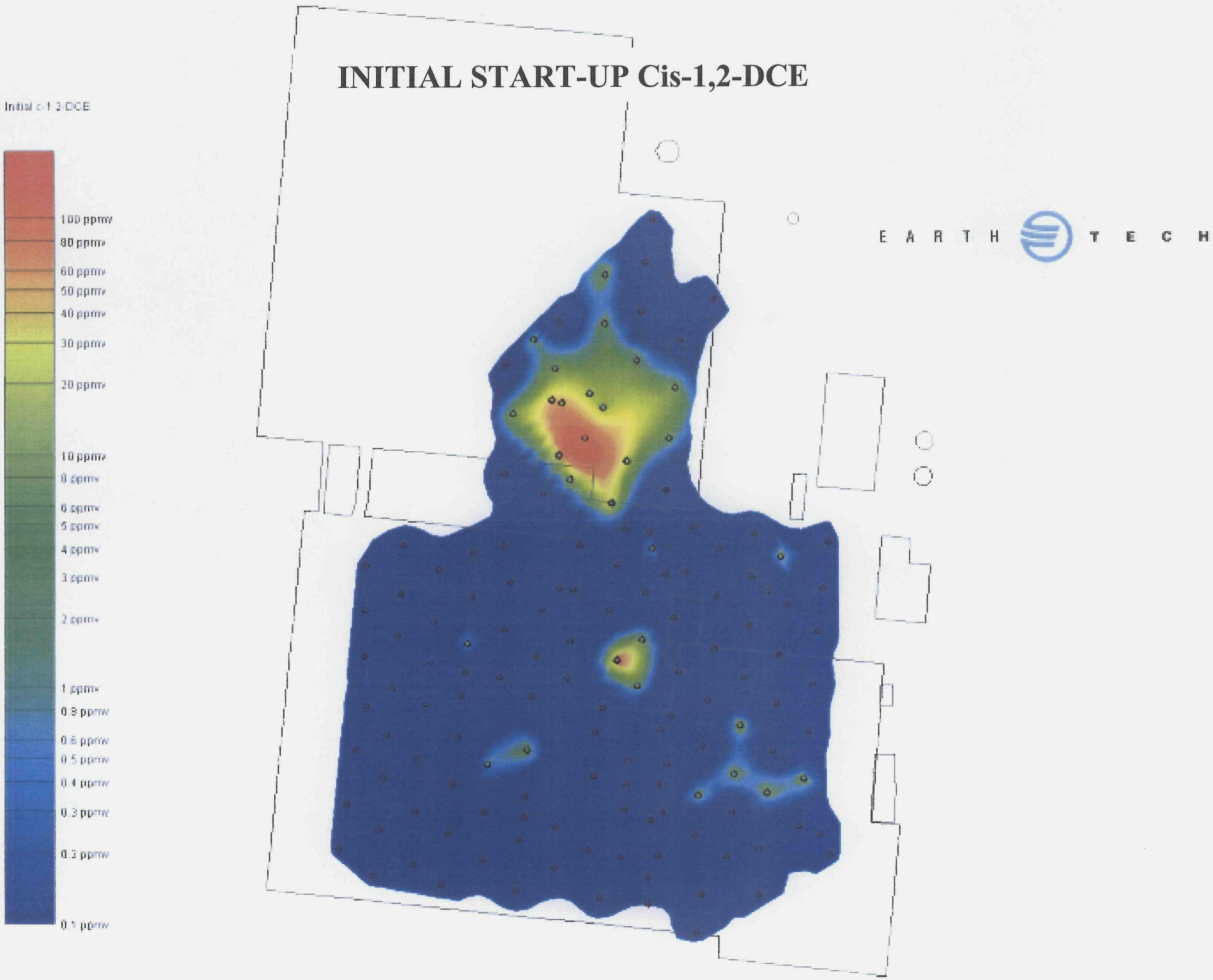
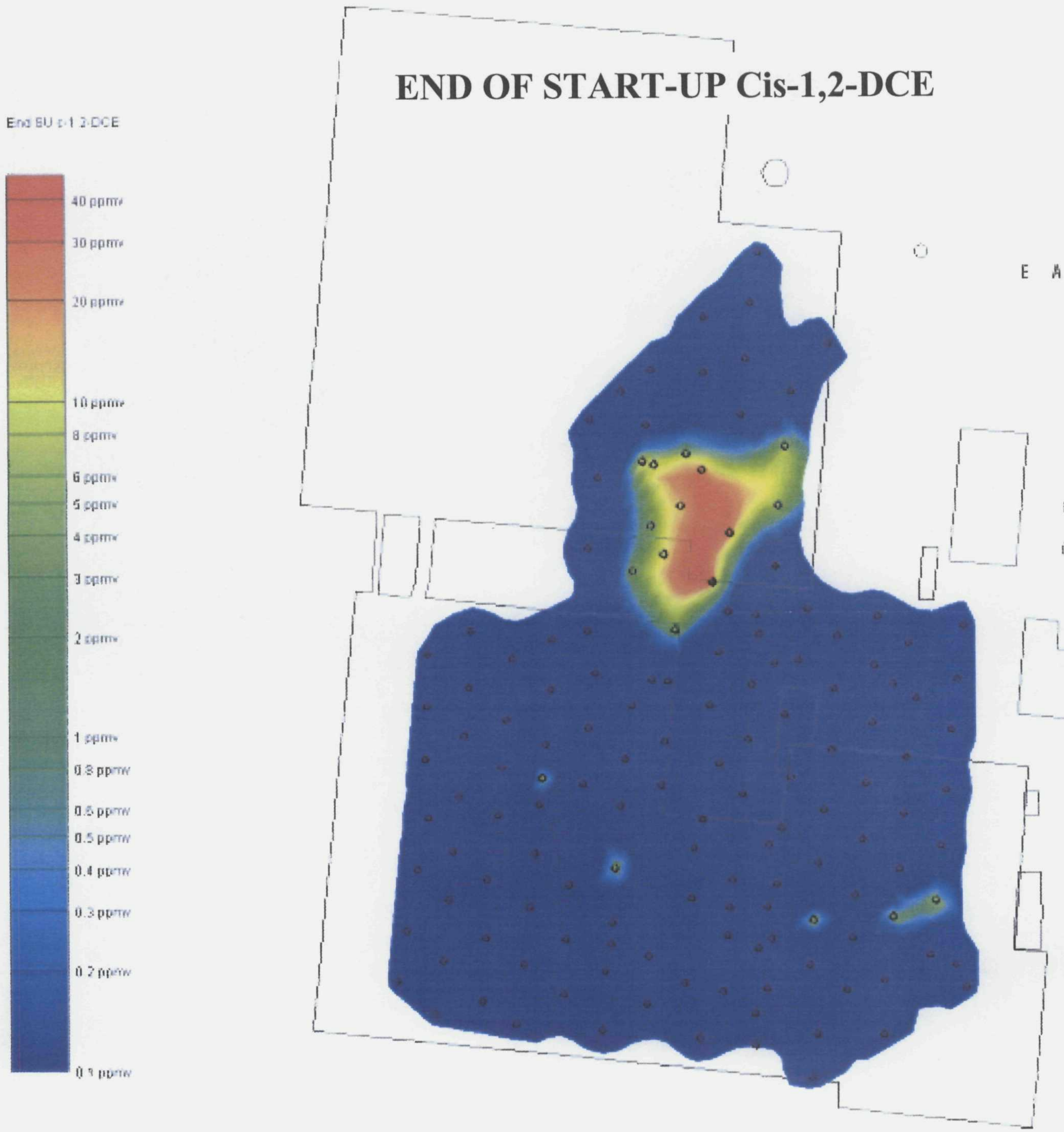


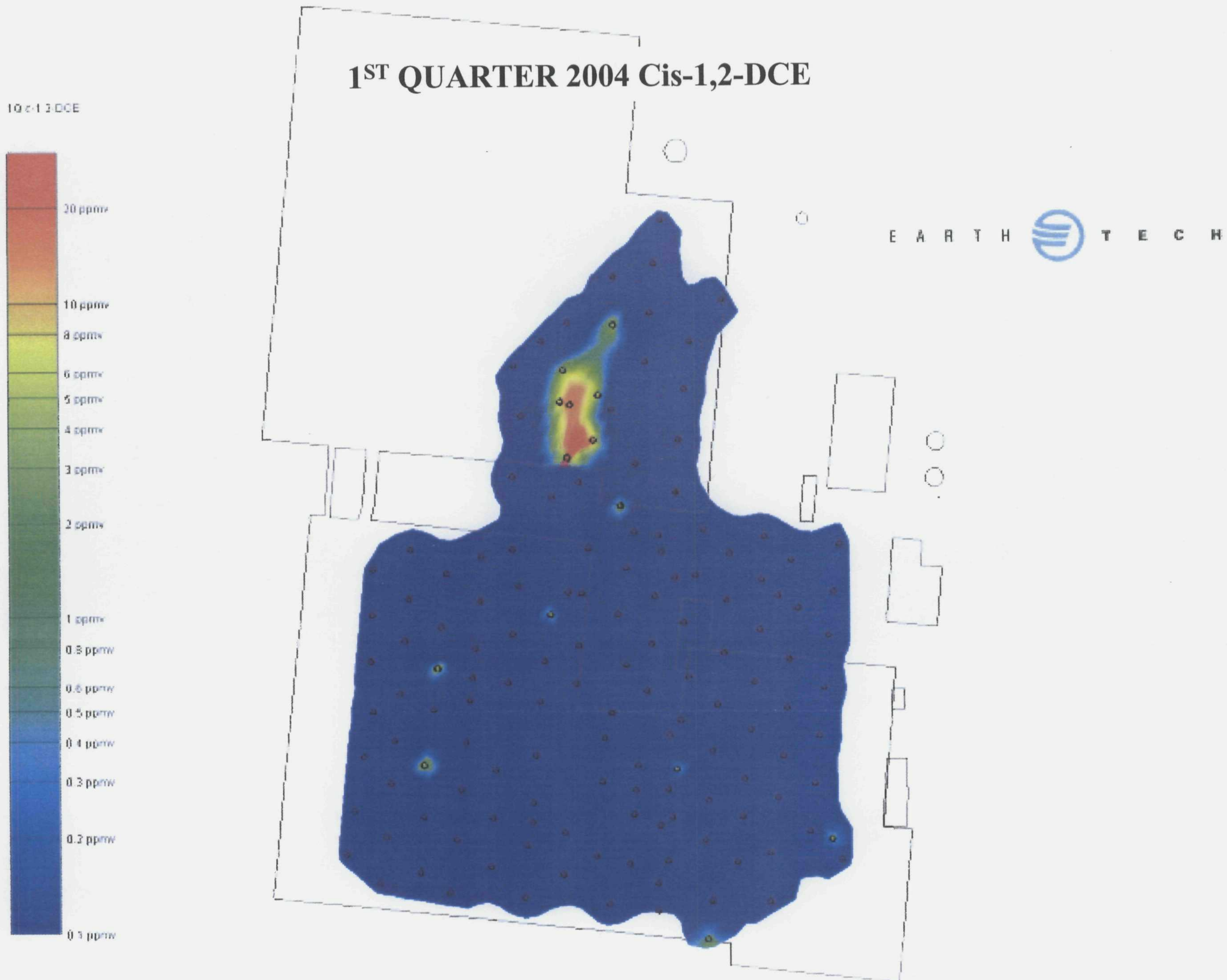
EARTH TECH

INITIAL START-UP Cis-1,2-DCE

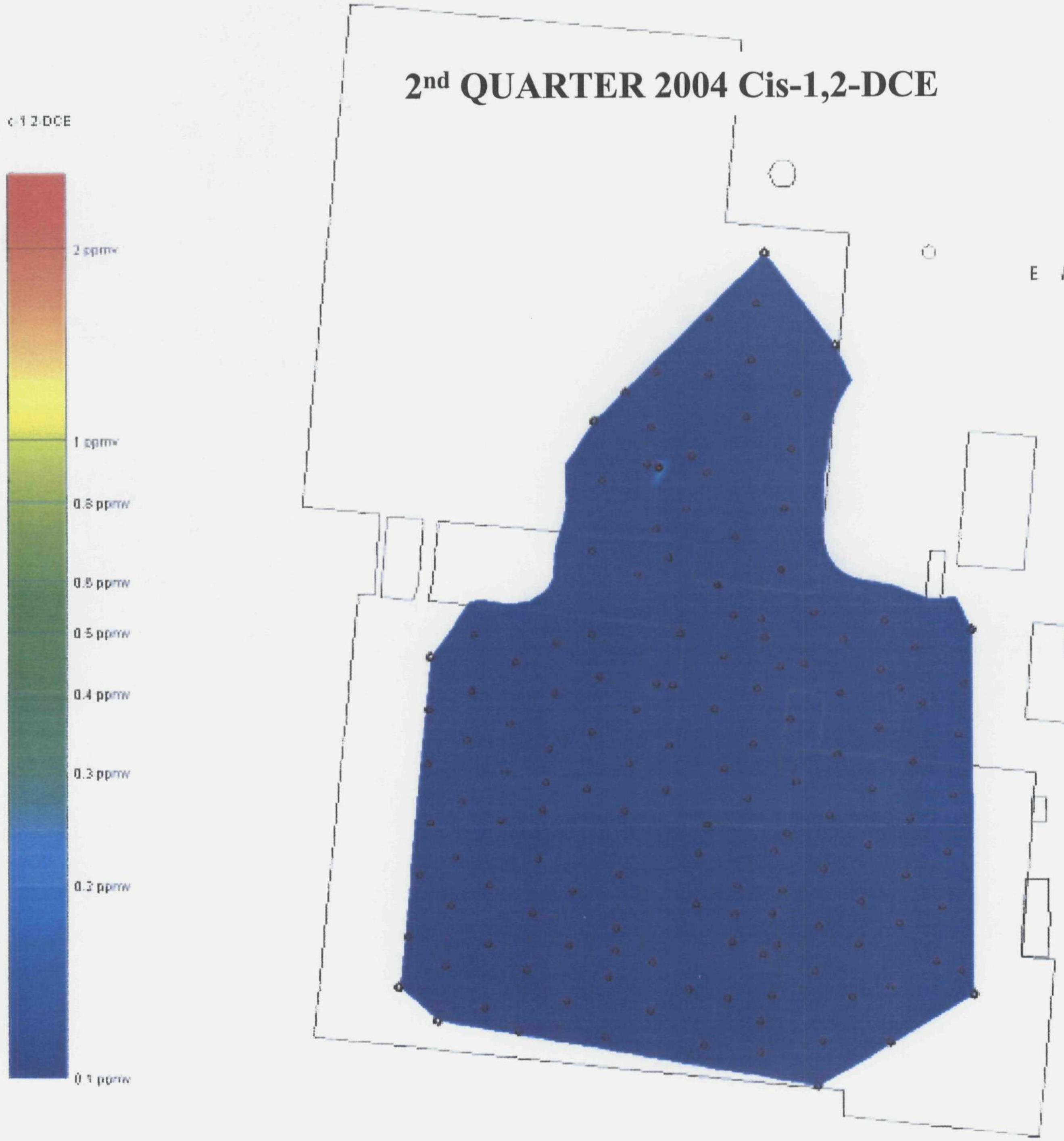


END OF START-UP Cis-1,2-DCE



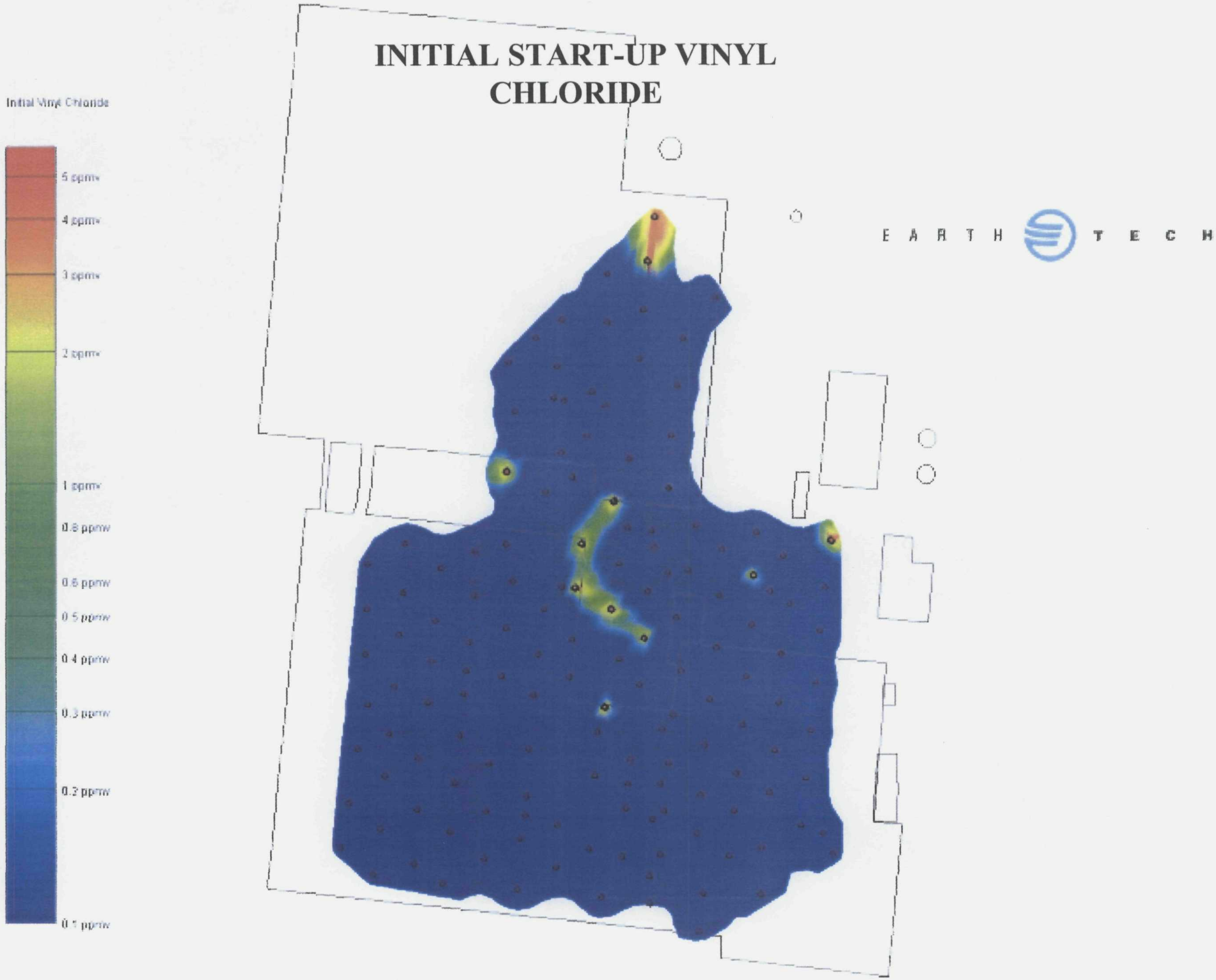

1ST QUARTER 2004 Cis-1,2-DCE
1Q c-1 2 DCE
20 ppmv
10 ppmv
8 ppmv
6 ppmv
5 ppmv
4 ppmv
3 ppmv
2 ppmv
1 ppmv
0.8 ppmv
0.6 ppmv
0.5 ppmv
0.4 ppmv
0.3 ppmv
0.2 ppmv
0.1 ppmv
EARTH TECH

2nd QUARTER 2004 Cis-1,2-DCE

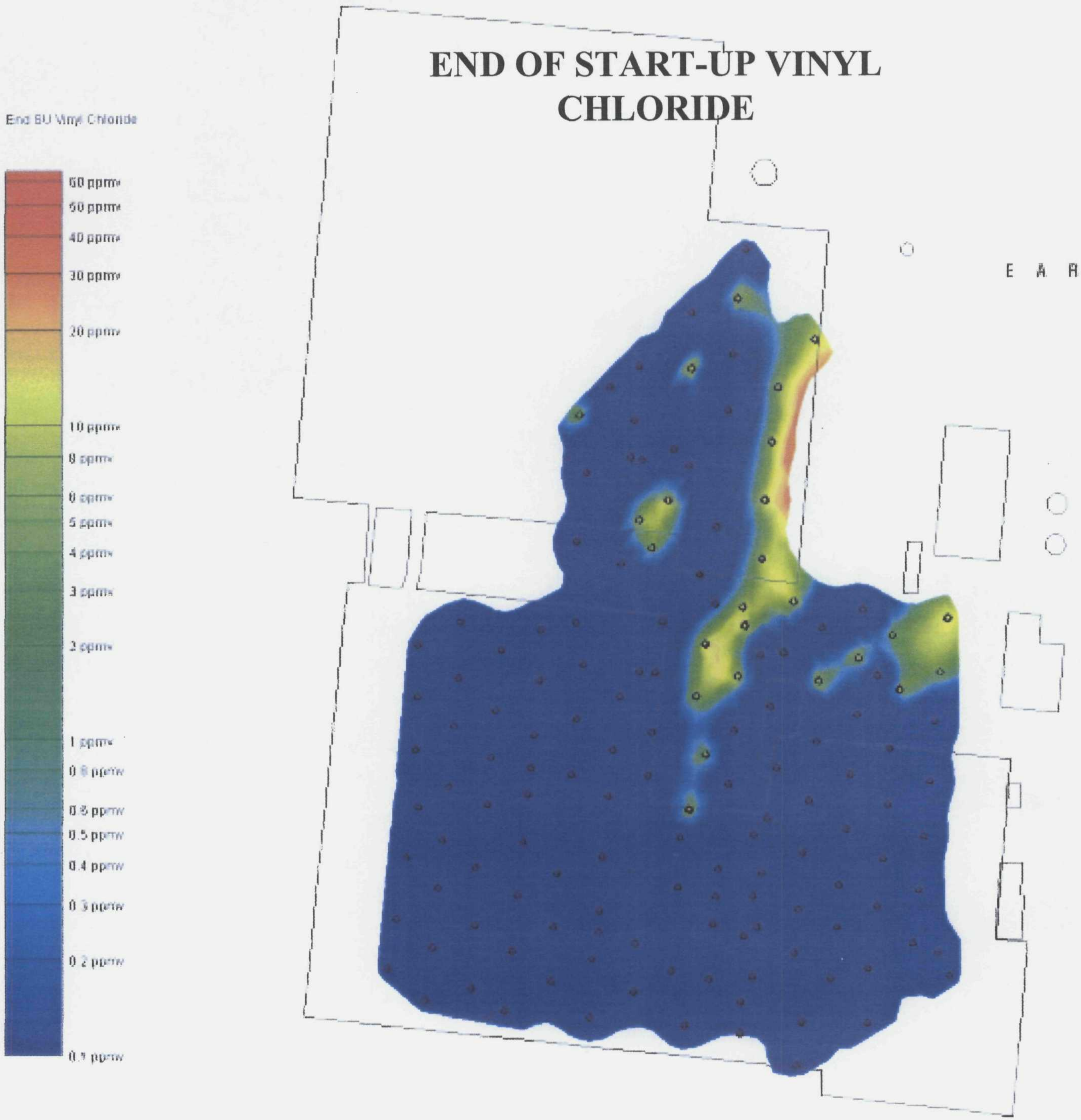


EARTH TECH

INITIAL START-UP VINYL CHLORIDE

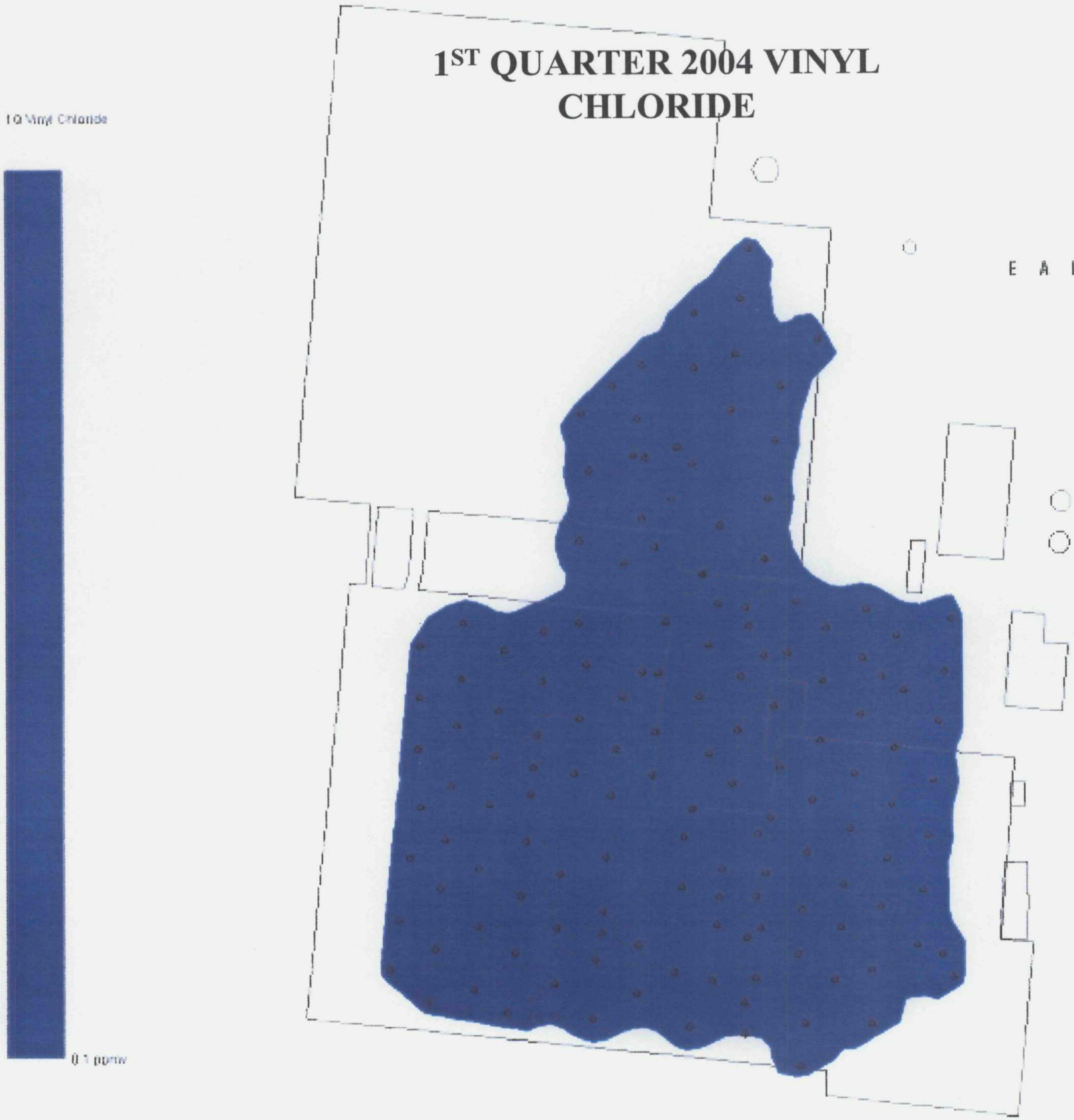


END OF START-UP VINYL CHLORIDE



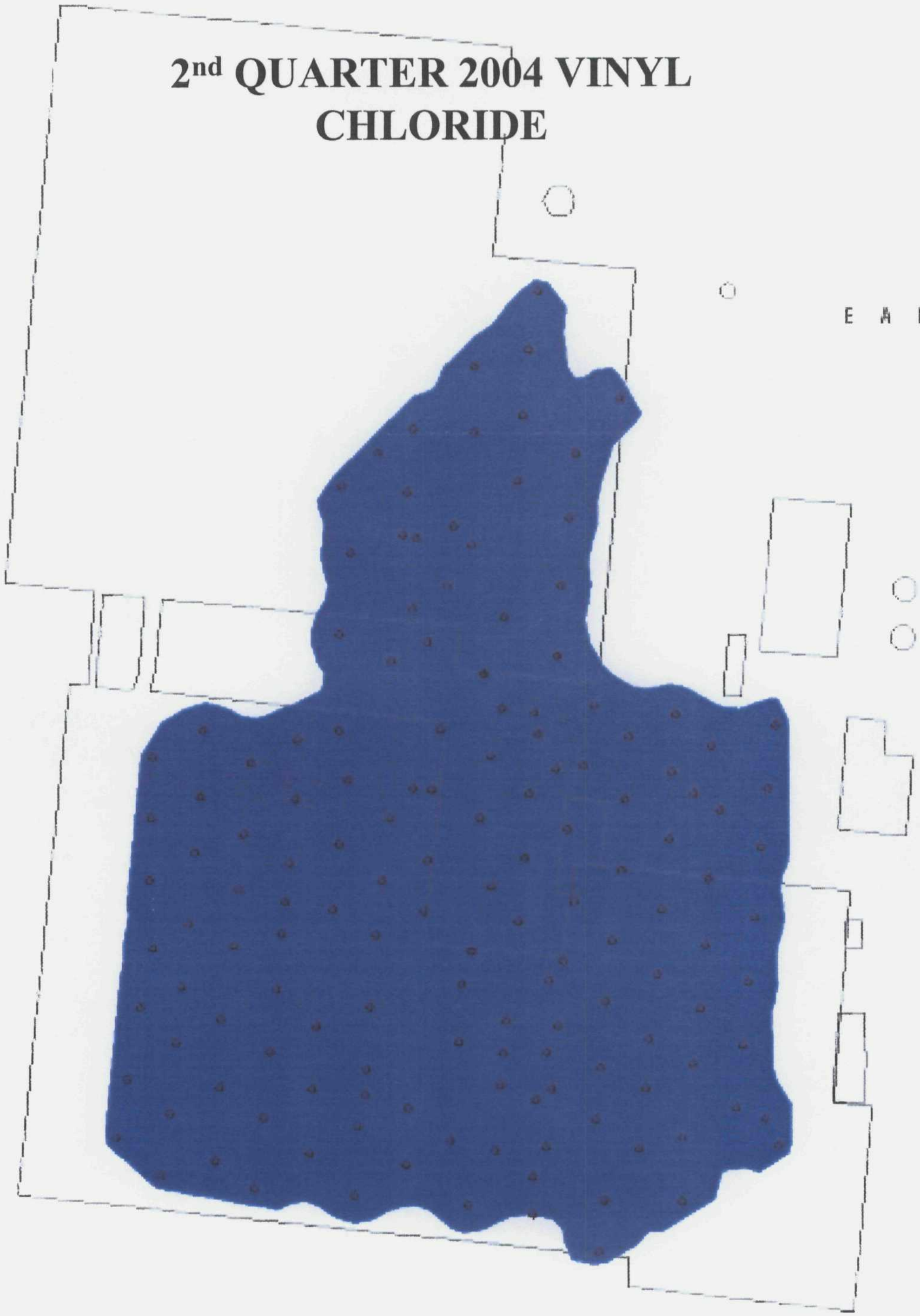
EARTH TECH

1[ST] QUARTER 2004 VINYL CHLORIDE



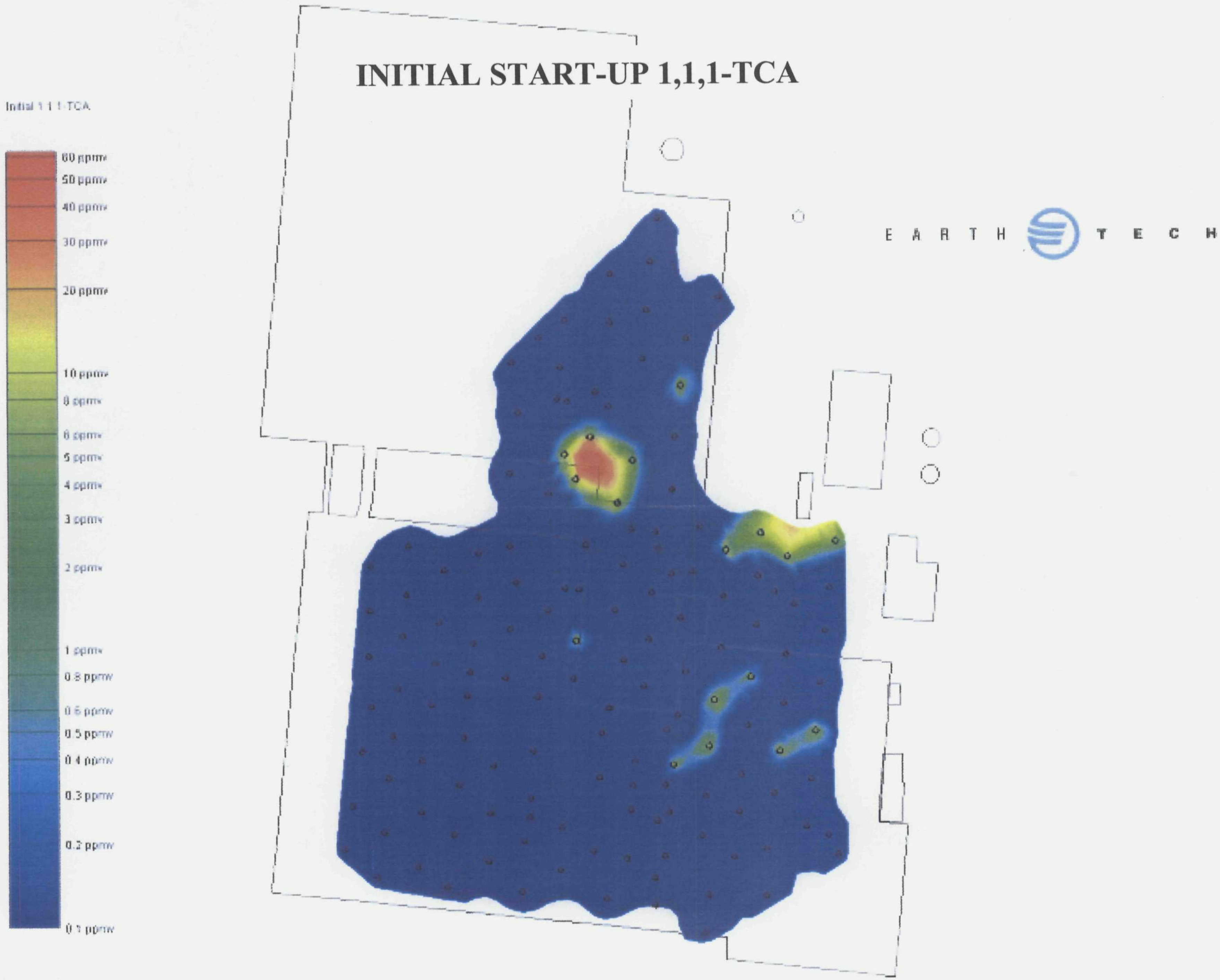
EARTH TECH

2nd QUARTER 2004 VINYL CHLORIDE

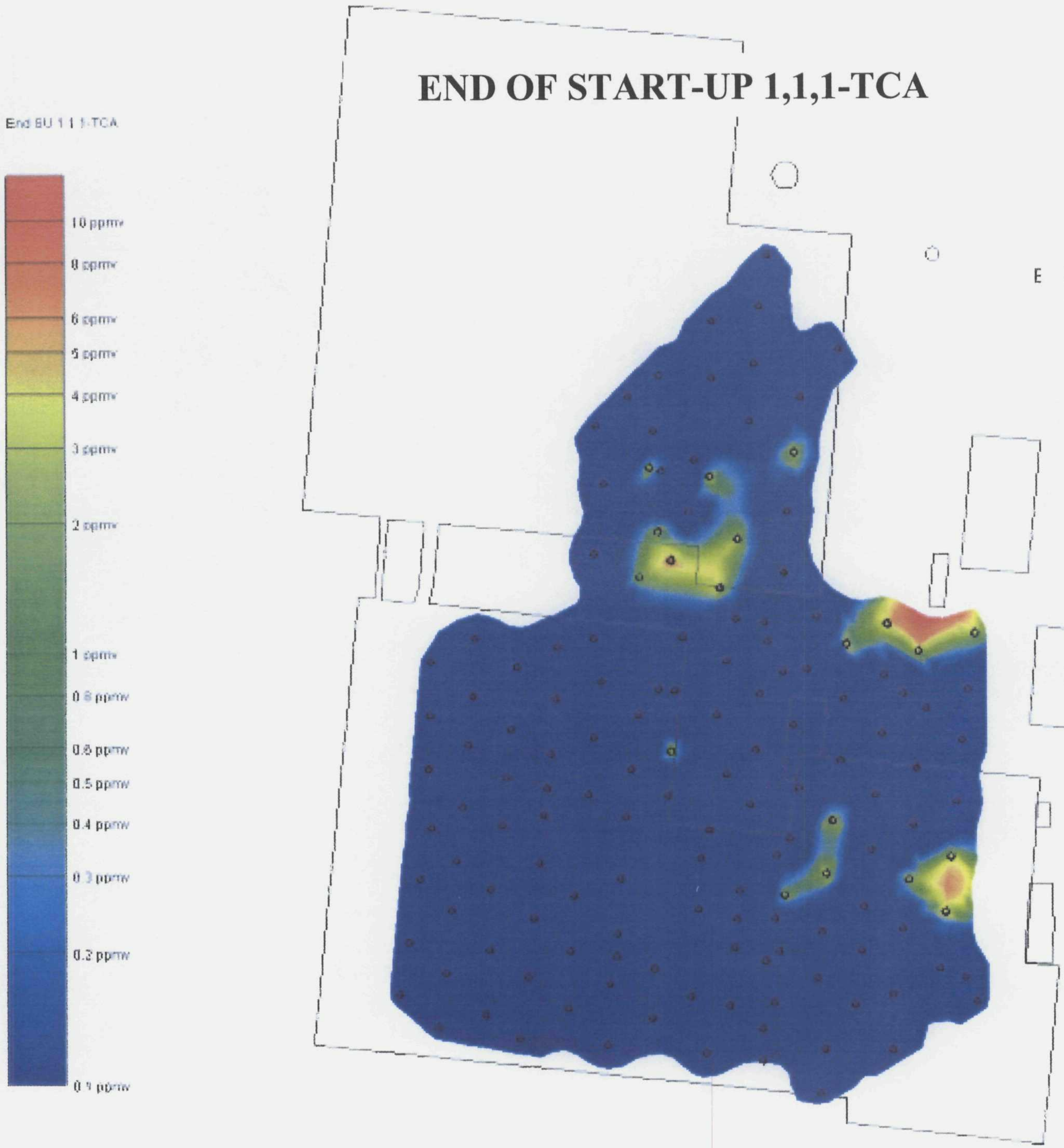


EARTH TECH

INITIAL START-UP 1,1,1-TCA

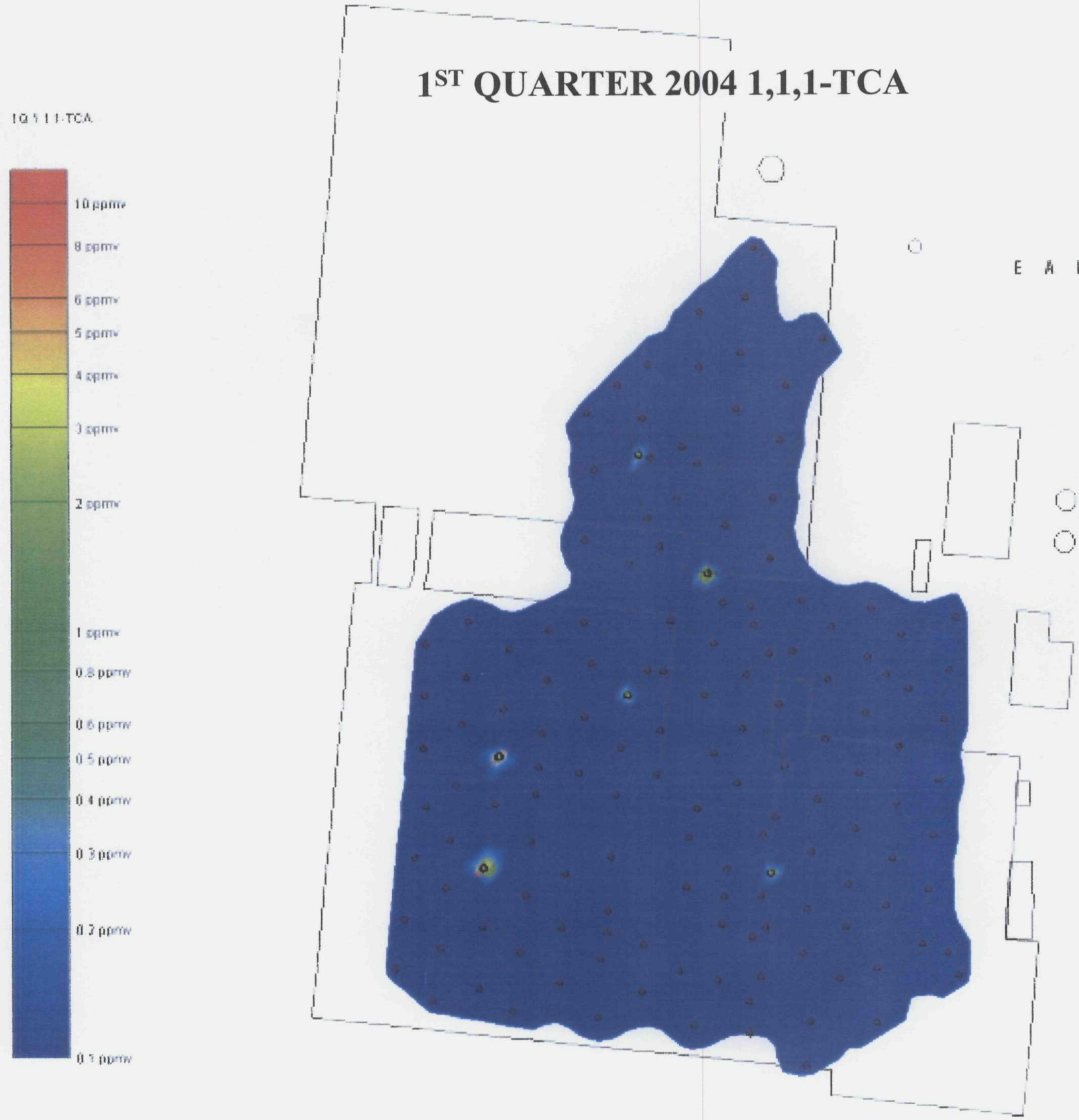


END OF START-UP 1,1,1-TCA



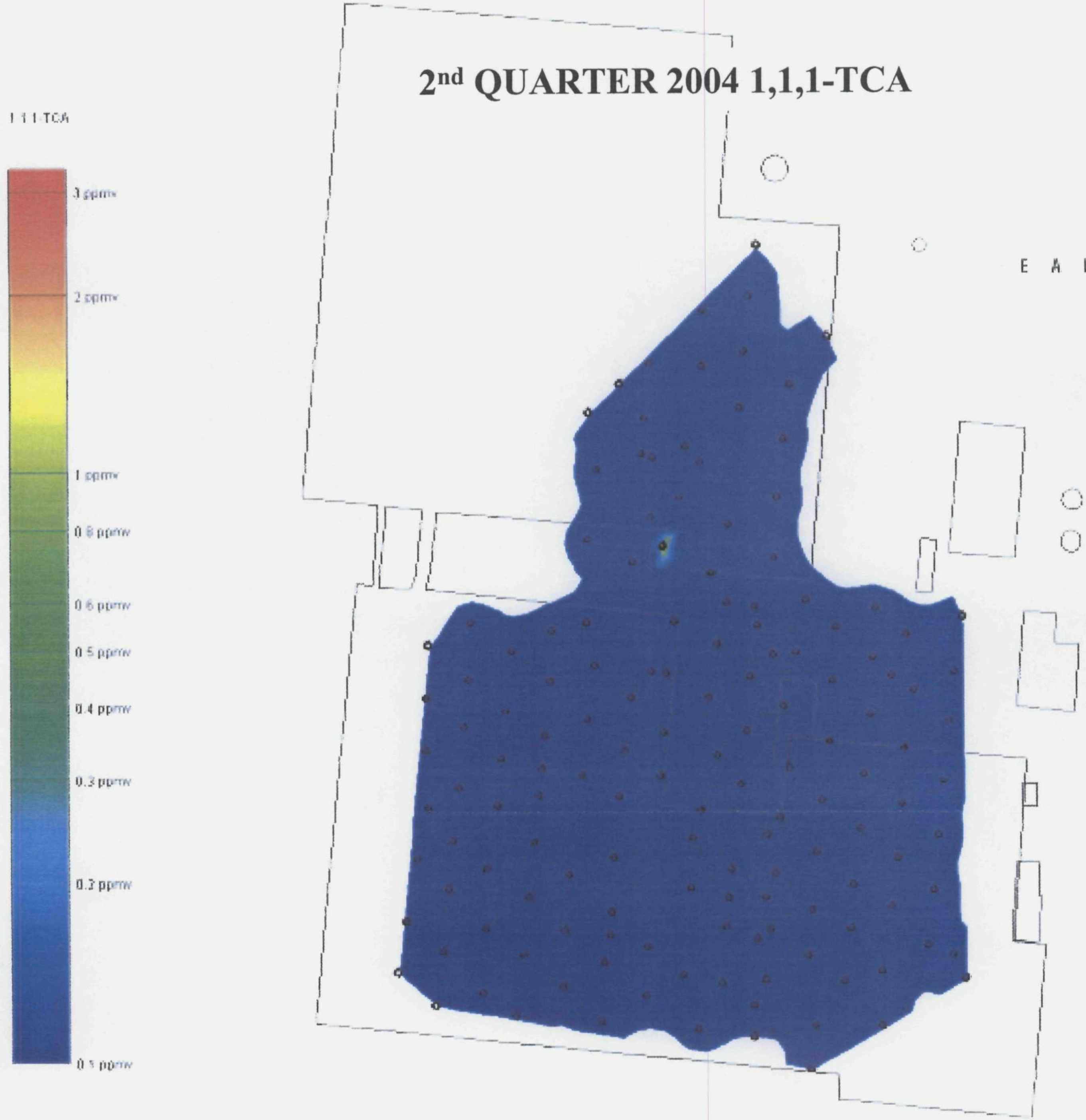
EARTH TECH

1ST QUARTER 2004 1,1,1-TCA

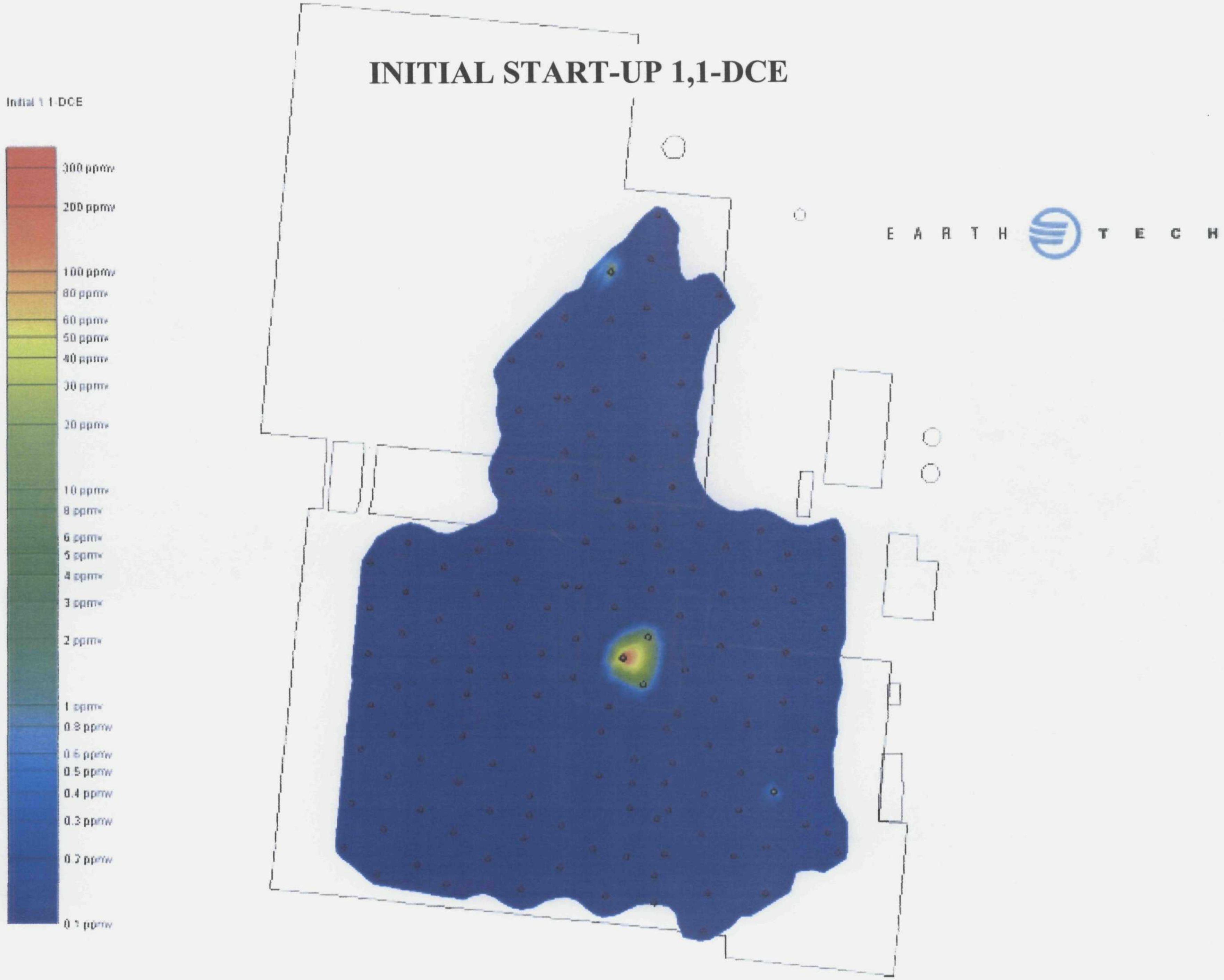


EARTH TECH

2nd QUARTER 2004 1,1,1-TCA



EARTH TECH


INITIAL START-UP 1,1-DCE
Initial 1,1-DCE
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200 ppmv
100 ppmv
80 ppmv
60 ppmv
50 ppmv
40 ppmv
30 ppmv
20 ppmv
10 ppmv
8 ppmv
6 ppmv
5 ppmv
4 ppmv
3 ppmv
2 ppmv
1 ppmv
0.8 ppmv
0.6 ppmv
0.5 ppmv
0.4 ppmv
0.3 ppmv
0.2 ppmv
0.1 ppmv
EARTH TECH